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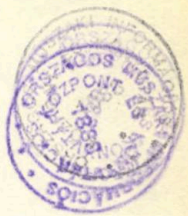

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Secţia VIII
TEXTILE. PIELĂRIE

LA MODÉLATION RHÉOLOGIQUE DU COMPORTEMENT DE FLUAGE DES FIBRES MELANA

PAR
OTILIA MÂLCOMETE, IRINA TĂRĂBOANŢĂ et V. BLAŞCU

1. Introduction. La mise en oeuvre dans la technologie textile d'une diversité de matières premières textiles pose des problèmes concernant leur comportement aux sollicitations mécaniques qui se déroulent en temps, mais aussi la conaissance des modifications qui peuvent intervenir dans leur structure.

C'est ainsi que l'étude du comportement rhéologique des produits macromoléculaires et des fibre textiles se réalise à l'aide des moyens théoriques mais aussi expérimentales, ayant pour base les principes de viscoélasticité nonlinéaire.

Les phénomènes de viscoélasticité mis en évidence par les processus de fluage et relaxation diffèrent beaucoup d'un type de fibre à l'autre, étant étroitement liés à la structure moléculaire et surmoléculaire, à la température, à la vitesse et aux conditions de sollicitation [1],...,[4].

L'étude de la viscoélasticité d'un matériau peut s'effectuer de trois façons: 1. L'élaboration des modèles théorique capables d'illustrer le comportement du matériau; 2. L'application des modèles basés sur des considérations théoriques; 3. La réalisation des essais (fluage, relaxation, sollicitations dynamiques) et la déduction des relations empiriques.

Cette étude présente la modélation mathématique du processus de fluage direct et inverse pour les fibres *Melana* en état fixe et nonfixe.

2. Partie expérimentale

2.1. Adoption du modèle rhéologique pour le fluage. Pour définir le comportement viscoélastique des fibres *Melana* on a employé la méthode de fluage, en choisissant le modèle rhéologique convenable.

La modélation du comportement au fluage est bassée sur le modèle K e l v i n - V o i g t généralisé. Pour le représentation des composantes de déformation qui se passe en fibres, on a ajouté un modèle M a x w e l l (M) – voir la figure 1 – dont l'équation

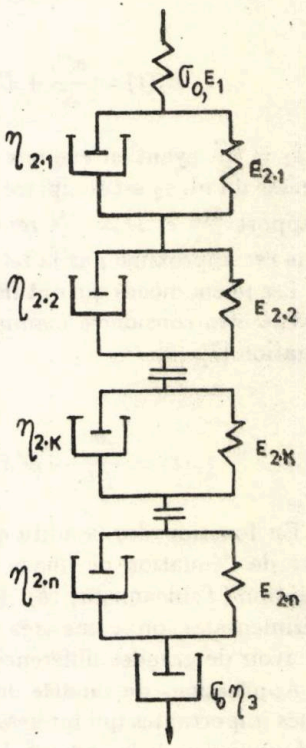

Fig. 1

est la suivante:

$$(1) \qquad \varepsilon(t) = \frac{\sigma_0}{E_1} + \sum_{k=1}^{n} \frac{\sigma_0}{E_{2k}} \left(1 - e^{-tE_{2k}/\eta_{2k}}\right) + \frac{\sigma_0}{\eta_3} t,$$

où: – la déformation élastique instantanée (ε_1) est donnée par le premier terme: $\frac{\sigma_0}{E_1}$;

– la déformation élastique retardée (ε_2) est donnée par le second terme:

$$\sum_{k=1}^{n} \frac{\sigma_0}{E_{2k}} \left(1 - e^{-tE_{2k}/\eta_{2k}}\right);$$

– la déformation rémanente (ε_3) est donnée par le troisième terme: $\frac{\sigma_0}{\eta_3} t$.

Le terme E_{2k} représente l'élasticité du système donnée par la modification de la conformation des cathènes et η_{2k} représente la réaction du milieu, c'est-à-dire sa viscosité.

Parce que le nombre des n élements K e l v i n - V o i g t est infini, ce qui mène à l'impossibilité de la connaissance des termes E_{2k} et η_{2k}, l'équation rhéologique (1) peut être assimilée en conditions de sollicitation de charge constante avec relaxation [5], [6]:

$$(2) \qquad E_s(t) = \frac{\sigma^m}{E} + D\sigma^n(1 - e^{-pt}) + B\sigma[-|t - c| + |t + c|],$$

où: $\varepsilon_1 = \frac{\sigma^m}{E}$ ayant en vue que E (le module d'elasticité) reste constant dans toute la masse du fil; ε_2 est remplacé par $D\sigma^n(1 - e^{-pt})$ ou l'inconnue p est remplacée par le rapport $\frac{E_{2k}}{\eta_{2k}}$ et $D = \frac{\varepsilon(t)}{\sigma(t)}$ représentant la compliance axiale et, enfin, le troisième terme est approximé par la relation: $B\sigma^n[-|t - c| + |t + c|]$.

Les phénomènes qui ont lieu après la suppression de la sollicitation (au retour) peuvent être considérés comme se déroulant selon les mêmes lois et, donc, on a l'équation [7], [8]:

$$(3) \qquad \varepsilon_r(t) = \frac{\sigma^{m'}}{E'} - D'\sigma^{n'}(1 - e^{-pt'}) - B'\sigma^{n'}[-|t - c| + |t + c|].$$

En fonction des conditions expérimentales adoptées, on a calculé les coefficients de l'équation de fluage dans des conditions de sollicitation mais aussi de relaxation (Tableaux 1*a*, 1*b*). En traçant les courbes théoriques de fluage et celles expérimentales, on a une très bonne concordance du modèle rhéologique adopté, sans avoir de grandes différences.

2.2. Applications du modèle de fluage dans le processus de retour. L'un des problèmes importantes qui intéresse les spécialistes concerne la détermination du temps nécessaire pour le „repos" des matériaux qui ont subi une série de sollicitations mécaniques. On sait que pour obtenir l'équilibre, après une sollicitation quelconque

Tableau 1*a*

	σ, $\frac{daN}{mm^2}$	Temps de sollic.,[min.]	Sollicitation						Retour					
			m	E	n	$P \cdot 10^{-3}$	$B \cdot 10^{-6}$	C	m'	E'	n'	$P' \cdot 10^{-4}$	$B' \cdot 10^{-7}$	C'
		1	0,737	153,07	1,585	1,4	2,09	60	1,35	458,66	1,087	4,16	2,4	900
		5	1.050	233,6	1,00	4,0	1,89	300	1,152	271,6	1,0	5,24	4,5	900
	3,089	10	1,222	330,8	1,585	1,13	1,67	600	1,271	289,2	1,152	4,36	3,8	900
Me-		15	0,954	183,34	1,00	2,81	1,62	900	1,228	249,9	1,070	5,39	3,3	900
la-		1	0,737	153,07	1,585	1,4	4,88	60	1,350	458,66	1,087	4,16	3,1	900
na		5	1,050	233,6	1,00	4,0	1,89	300	1,152	271,6	1,0	5,24	3,6	900
	6,179	10	1,222	330,8	1,585	1,13	0,79	600	1,271	289,2	1,152	4,36	3,1	900
fi-		15	0,954	183,34	1,00	2,81	*2,47	900	1,228	249,9	1,070	5,39	2,8	900
xé		1	1,172	247,57	0,873	7,40	14,3	60	1,050	132,28	1,4094	1,78	1,41	900
		5	2,015	705,4	1,261	3,21	0,8	300	1,804	910,04	1,583	1,30	1,5	900
	9,267	10	1,921	993,91	1,571	0,71	0,42	600	1,858	941,3	1,491	1,73	1,2	900
		15	2,540	439,0	1,409	0,58	0,57	900	2,497	4443,0	2,409	0,178	0,156	900
		1	1,172	247,57	0,873	7,40	16,68	60	1,015	132,28	1,4094	1,78	2,4	900
		5	2,015	705,4	1,261	3,21	0,8	300	1,804	910,04	1,583	1,30	1,2	900
	12,356	10	1,921	993,91	1,571	0,71	0,61	600	1,858	941,3	1,491	1,73	1,2	900
		15	2,540	439,0	1,409	0,58	0,67	900	2,497	4443,0	2,409	0,179	0,104	900

Tableau 1*b*

	σ, $\frac{daN}{mm^2}$	Temps de sollic.,[min.]	Sollicitation						Retour					
			m	E	n	$P \cdot 10^{-3}$	$B \cdot 10^{-6}$	C	m'	E'	n'	$P' \cdot 10^{-4}$	$B' \cdot 10^{-7}$	C'
		1	0,909	181,95	1,115	2,7	6,5	60	1,415	526,48	1,169	3,41	2,0	900
		5	1,0	1,86	0,678	3,89	5,51	300	0,807	147,3	0,584	14,1	11	900
	3,348	10	1,146	285,28	1,378	1,61	3,00	600	1,378	352,42	1,263	3,83	1,8	900
Me-		15	1,174	211,87	0,585	3,46	2,33	900	1,156	231,0	1,07	4,91	3,0	900
la-		1	0,909	181,95	1,115	2,7	8,5	60	1,415	526,48	1,169	3,41	1,8	900
na		5	1,0	1,86	0,678	3,89	6,89	300	0,807	147,3	0,584	14,1	6,4	900
	6,696	10	1,146	285,28	1,378	1,61	2,73	600	1,378	352,42	1,263	3,83	2,5	900
non-		15	1,174	211,87	0,585	3,46	3,29	900	1,156	231,0	1,07	4,91	1,8	900
fi-		1	2,545	5684	0,707	12,02	26,05	60	2,015	1866,6	1,571	1,26	1,1	900
xé		5	1,856	1064,2	0,485	13,18	25,59	300	1,092	158,2	0,866	7,46	6,8	900
	10,0	10	1,558	415,87	0,464	14,87	21,14	600	0,971	104,37	0,524	34,1	11,6	900
		15	1,472	328,3	1,945	0,15	0,22	900	0,873	76,56	1,16	3,54	4,1	900
		1	2,545	5684	0,707	12,02	17,93	60	2,015	1866,6	1,571	1,26	0,89	900
		5	1,856	1064,2	0,485	13,18	18,7	300	1,092	158,2	0,886	7,46	5,6	900
	10,0	10	1,558	415,87	0,464	14,87	16,5	600	0,971	104,37	0,524	34,1	7,8	900
		15	1,472	328,3	1,945	0,15	0,15	900	0,873	76,56	1,16	3,54	2,7	900

des fibres, il est nécessaire, parfois, un temps prolongé, ce que fait impossible les considerations pratiques des mêmes durées [7].

Pour nous maintenir dans ces limites raisonnables, le calcul du temps de retour (t_R) a été réalisé en considérant que le retour se fait non pas jusqu'à l'état initial (qui d'habitude ne peut pas être obtenu), mais jusqu'à l'état d'une valeur de la déformation irréversible correspondant à la moindre charge de sollicitation et à la courte durée de sa mise en mouvement.

On a calculé le temps de retour selon la base des dates expérimentales (les Tableaux 2 *a*, 2 *b*) et de l'équation rhéologique pour le processus de retour avec la relation:

$$\varepsilon_r(t) = \varepsilon_r(5'') - 2\beta'_r\sigma^{n'_r}t_r, \tag{4}$$

d'où

$$t_r = \frac{\varepsilon_r(5'') - 0,2\cdot 10^{-2}}{2\beta'_r\sigma^{n_r}}; \quad \varepsilon(t_r) = \frac{0,04}{20}\cdot 100 = 0,2\% = 0,2\cdot 10^{-2}\ \text{mm}. \tag{5}$$

Tableau 2*a*

	P_S, cN	Temps de sollic.,[min.]	Déformation totale,Δt,[%]	Déform.élast. ε_1,[%]	Déform.élast. ε_2,[%]	Déform.reman.,ε_3,[%]	Degré d'élast.,[%]
Melana fixé	1	1	1,9	47,36	28,94	23,68	76,3
		5	2,5	50,00	24,00	26,00	74,0
		10	2,6	44,23	26,92	28,84	71,15
		15	2,75	41,81	25,45	32,72	67,26
	2	1	4,3	40,69	29,06	30,23	69,75
		5	4,8	37,5	27,08	35,41	64,58
		10	5,1	31,37	28,43	40,19	59,80
		15	6,35	40,94	22,04	37,0	62,98
	3	1	8,1	40,74	24,69	34,56	65,43
		5	8,6	29,06	25,58	45,34	54,64
		10	9,7	31,44	25,25	43,29	65,69
		15	9,25	37,83	17,83	44,32	55,66
	4	1	15,5	37,41	21,29	41,29	58,70
		5	15,75	33,92	20,63	45,44	54,55
		10	17,9	36,59	17,03	46,36	53,62
		15	18,3	34,42	16,93	48,63	51,35

On peut voir les temps de retour obtenus dans le Tableau 3.

3. Interpretation des résultats. Pour le calcul des caractéristiques rhéologiques on a réalisé un programme Fortran sur ordinateur.

En suivant l'analyse des valeurs obtenues pour le temps de retour (le Tableau 3) et les valeurs obtenues pour la détermination de la déformation totale sous

Tableau 2*b*

	P_S, cN	Temps de sollic.,[min.]	Déformation totale,Δt,[%]	Déform.élast. ε_1,[%]	Déform.élast. ε_2,[%]	Déform.reman.,ε_3,[%]	Degré d'élast.,[%]
Melana non-fixé	1	1	2,25	52,33	22,44	23,22	74,77
		5	2,8	34,71	39,28	26,00	73,99
		10	2,6	42,3	25,00	32,69	67,30
		15	3,00	41,66	23,33	35,00	64,99
	2	1	4,6	39,13	26,08	34,78	65,21
		5	5,5	37,72	25,45	36,81	63,17
		10	6,0	30,00	29,00	41,00	59,00
		15	6,5	40,00	20,00	40,00	60,00
	3	1	9,4	40,42	22,87	36,70	63,29
		5	12,5	34,20	19,80	46,00	54,00
		10	13,5	33,33	21,11	45,55	54,44
		15	11,9	29,54	18,85	51,60	48,39
	4	1	16,25	38,46	19,38	42,15	57,83
		5	16,70	35,62	17,96	46,41	53,58
		10	18,1	34,25	16,85	48,89	51,10
		15	18,9	33,33	16,40	50,26	49,73

Tableau 3

		Temps de sollicitation, T_S,[min]			
		1	5	10	15
		Temps de retour, T_R,[min]			
Melana fixé	1	40,7	47,96	57,84	67,9
	2	55,6	71,17	95,80	105,9
	3	87,7	95,25	126,77	142,49
	4	97,3	113,75	147,11	168,12
Melana non-fixé	1	45,6	53,6	70,56	80,01
	2	75,08	81,34	105,47	120,2
	3	98,72	106,81	142,53	150,8
	4	120,05	127,69	152,19	180,8

charge de retour élastique instantané (ε_1), de retour élastique retardé (ε_2) et de la déformation rémanente (ε_3) et du degrè d'élasticité (G_{el}), il s'ensuit que:

– pour la même charge de sollicitation, avec augmentation de la durée de sollicitation (1, 5, 10, 15 min.) diminue le retour élastique donc le degré d'élasticité et augmente la déformation rémanente (fig. 2);

– on constate pour la même durée de sollicitation, mais pour des forces de sollicitation croissantes (1, 2, 3, et 4 cN), la même tendance de réduction de la capacité de retour élastique et d'augmentation de la déformation rémanente (fig. 3);

– les réductions des capacités de retour sont plus accentuées à l'augmentation

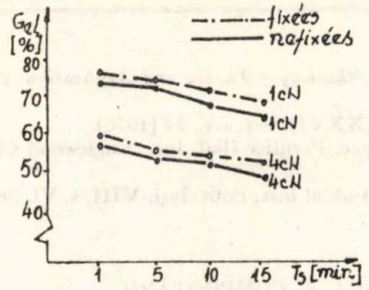

Fig. 2

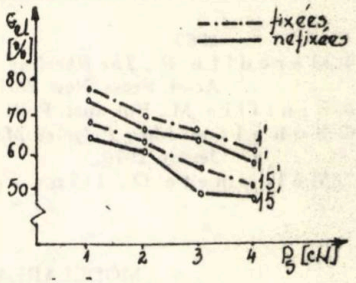

Fig. 3

de la force de sollicitation pour la même durée de la sollicitation, que dans le cas de la conservation de la force constante et de la durée de la sollicitation.

En analysant les valeurs du temps de retour (t_R) obtenues dans les conditions expérimentales adoptées, on constate que celui-ci augments avec la croissance de la force de sollicitation et avec la durée (fig. 4).

On constate des augmentations du temps de retour aux sollicitations avec des forces croissantes, par rapport à l'augmentation de la durée de sollicitation à une force constante. D'ici, la conclusion qu'avec l'augmentation de la force de sollicitation, les modifications structurales sont plus profondes au niveau de la fibre, d'où l'augmentation du temps de retour.

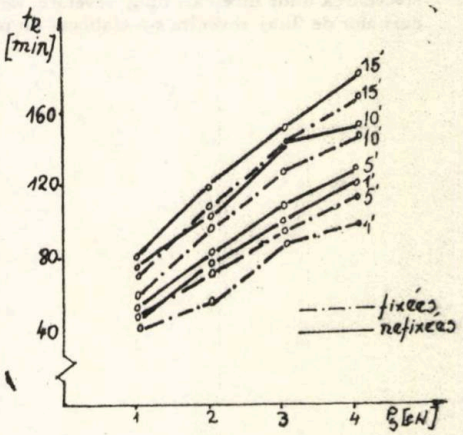

Fig. 4

En suivant le comportement au fluage direct et inverse des fibres *Melana* nonfixées et fixées, on constate le fait que dans toutes les conditions expérimentales, les déformations totales sous charge sont plus grandes aux fibres nonfixées et la capacité de retour élastique est plus petite aux fibres nonfixées qu'aux fibres fixées. Le même aspect résulte des valeurs du temps de retour qui est plus grand aux fibres nonfixées qu'aux fibres fixées.

Cet aspect illustre le fait que la fixation des fibres est absolument nécessaire pour la stabilisation de la structure responsable de propriétés d'élasticité.

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MODELAREA REOLOGICĂ A COMPORTĂRII LA FLUAJ A UNOR FIBRE MELANA

(Rezumat)

Studiul comportării reologice a fibrelor Melana în stare fixată şi nefixată s-a realizat atât cu ajutorul mijloacelor teoretice prin adoptarea unui model reologic, cât şi experimental, prin efectuarea unor încercări fluaj–revenire, iar pentru calculul caracteristicilor reologice şi trasarea curbelor de fluaj–revenire s-a elaborat un program pe calculator.

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PHYSICO-MECHANICAL AND RHEOLOGICAL BEHAVIOUR OF CHEMICALLY-MODIFIED POLYVINYLALCOHOL FIBERS

BY

V. BLAŞCU, OTILIA MÂLCOMETE and JULIETA HOMUTESCU

1. Introduction. It is common knowledge that, due to their special physico-mechanical and chemical properties, polyvinylalcohol fibers (PVA) have been largely utilized in both textile industries and various technical fields [1].

Similarly to other hydroxylated polymers, PVA fibers may be modified by chain reactions, occurring especially in the amorphous regions, inducing lowering of hydrophylicity and structural rearrangements of these instable regions, yet without affecting sensibly the crystalline portions. For example, the reaction of formolysis modifies the PVA fibers tensional properties, hydrophylicity and tinctorial affinity [2].

More recently, polyvinylalcohol is used in drug retardation, too [3],[4]; in such situations, PVA has been used as powder, wholly soluble in water – i.e, nonreticulated.

In our experiments on drug retardation, we employed partially soluble PVA fibers as support in polymer-analogous reactions.

The present paper discusses the modifications observed in the physico-mechanical and rheological behaviour of chemically modified PVA fibers, for their possible utilization in technological processes of thread spinning, as well as in weaving mills or knitted works.

2. Experimental. Partially soluble PVA fibers, coupled with nalidixic acid and nitrofural, have been subjected to physical and mechano-rheological analyses.

From the physical properties, there have been established hydrophylicity, fineness and ondulation. Also, the critical time of dissolution – as a way of evidencing the fibers supermolecular structure has been determined.

Mechano-rheological characterization involved determination of the parameters of charge-deformation curves, instantaneous and delayed elastic deformation, degree of elasticity and rate of recovery.

Table 1 presents the codification of samples.

Hydrophylicity has been determined by climatization of samples at $\varphi = 65\%$, for 48 hours, followed by drying up to constant weight. The results are given in Table 2. In the case of coupling with nitrofural, a stronger decrease of hygroscopicity is to be observed, similar to coupling with nalidixic acid, as compared with the reference sample, due to an additional reticulation of the fiber in the presence of nitrofural, possessing a carbonylic structure.

Table 1
Codification of Samples

Sample no.	Coupling degree of the nalidixic acid, $\left[\frac{\text{mg AcNx}}{\text{g PVA}}\right]$	Coupling degree of nitrofural, $\left[\frac{\text{mg nitrofural}}{\text{g PVA}}\right]$
Reference	–	–
1	0.2	–
2	0.4	–
3	0.6	–
4	0.8	–
5	1	–
6	–	0.2
7	–	0.4
8	–	0.6
9	–	0.8
10	–	1

Table 2
Physical Properties

Sample no.	Amount of absorbed water, $\frac{\text{g } H_2O}{\text{g fb}}$	Critical time of disolution in DMF, [sec.]	Fineness	$\frac{n_0}{\text{cm}}$	G_i %	G_i' %	S %
Reference	0.035	80	0.214	3.84	16.35	10.12	65.24
1	0.034	72	0.218	3.60	16.27	10.63	68.14
2	0.023	68	0.220	3.48	15.98	11.24	71.00
3	0.018	65	0.223	3.40	15.83	11.86	74.86
4	0.014	62	0.224	3.38	15.60	12.18	76.01
5	0.012	60	0.228	3.38	15.51	12.63	77.24
6	0.020	85	0.228	3.43	16.42	11.84	72.10
7	0.010	89	0.232	3.76	18.09	13.65	75.45
8	0.008	95	0.246	3.92	20.10	16.11	80.14
9	0.004	101	0.250	4.20	21.81	18.46	84.64
10	0.003	110	0.255	4.70	23.32	20.27	86.92

The fibers fineness has been determined on representative, climatized samples, by gravimetry. The average values obtained are presented in Table 2. A slight decrease of fineness with increase of the coupling degree is to be observed, as due to an additional process of reticulation; nevertheless, this decrease is nonsignificant in textile technological processes.

Undulation characteristics have been expressed with the following parameters:

– number of crimps on the unit of length (n_0/cm), considering as undulations the number of arcs towards the median axis of the fiber, placed on one of its sides;

– initial degree of curling, calculated with the following relation (G_i, %):

$$G_i = \frac{l_1 - l_0}{l_0} \cdot 100,$$

where l_0 – length of the undulated fiber (mm); l_1 – length of the non-crimped fiber (mm); the fiber pre-tensioning has been performed with 0.002 cN/fb, while tensioning with 0.8 cN/fb;

– the crimping degree after one minute-stress, with a non-crimping force of 0.8 cN/fb, followed by one minute relaxation (G_i'):

$$G_i' = \frac{l_1' - l_0}{l_1'} \cdot 100;$$

– undulation stability:

$$S = \frac{G_i'}{G_i} \cdot 100.$$

The experimental results obtained are presented in Table 2.

Analysis of the physical parameters leads to the following conclusions:

– the amount of water absorbed by the modified fiber is more reduced than that absorbed by the reference sample, hygroscopicity being lower with fibers coupled with nitrofural, as due to the partial blocking of the hydroxylic groups in the fiber, by esterification with micromolecular compounds; additionally, in the case of nitrofural, the explanation might be an additional reticulation between the macromolecular chains;

– the critical time of dissolution decreases proportionally with the coupling degree, in the samples coupled with nalidixic acid, which might explain fiber slight destructuring. In its turn, the dissolution time increases proportionally to the coupling time, which possibly explains an additional structuring through reticulation as compared with the reference sample;

– fineness of the chemically coupled fibers decreases slightly as compared with the reference sample, the decrease being more evident with fibers treated with nitrofural;

– the undulation characteristics show lower values for the samples coupled with nalidixic acid, as compared with the reference samples, and sensibly higher values, proportional to the coupling degree, for the samples coupled with nitrofural.

The mechanical parameters have been determined from the charge-deformation curves, recorded on a Fafegraph-type electronic dynamometer. The average values of 10 determinations, for each sample, are presented in Table 3.

A decreasing tendency of the parameters values is observed: the initial modulus of elasticity (E_I), the tensional indices of the limits of elasticity, flow and break (P, σ, ε), the specific mechanical work (Lms), along with an increase of deformation in the considered regions, for the samples coupled with nalidixic acid, and the inverse evolution of the parameters at the samples coupled with nitrofural. All

Table 3
Mechanical Characteristics

Sample no.	E_I, cn/tex	Limit of elasticity			Limit of flow			Limit of breaking			Specific mechanical work Lms, [cN/tex]
		P_e, cN/fb	σ_e, cN/tex	ε_e, %	P_c, cN/fb	σ_c, cN/tex	ε_c, %	P_r, cN/fb	σ_r, cN/tex	ε_r, %	
Reference	224.8	4.01	18.73	3.20	4.90	22.89	11.2	6.34	29.62	24.1	3.28
1	220.1	3.96	18.16	3.28	4.80	22.01	11.8	6.30	28.89	25.2	3.10
2	219.5	3.50	15.90	3.45	4.70	21.36	12.1	6.24	28.36	25.9	3.07
3	218.7	3.22	14.43	3.60	4.68	20.98	12.4	6.27	27.84	26.2	3.05
4	218.0	2.81	12.54	3.93	4.65	20.75	12.6	6.20	27.67	26.8	3.03
5	217.4	3.80	16.66	3.91	4.64	20.35	12.7	6.18	27.10	27.4	3.01
6	229.0	4.20	18.42	3.14	5.02	22.07	13.8	6.46	28.33	22.4	3.20
7	246.1	4.43	19.09	3.02	5.18	22.32	14.5	6.70	28.87	21.7	3.38
8	259.3	4.81	19.55	2.91	5.37	21.82	15.9	6.95	28.25	21.0	3.45
9	277.5	5.25	21.00	2.82	5.60	22.40	17.0	7.14	28.56	20.4	3.53
10	298.4	5.81	22.78	2.76	5.91	23.17	18.3	7.44	29.17	20.8	3.66

these prove the modifications produced in the PVA fibers supramolecular structure by the coupled micromolecular substances, scission of some intercatenary etheric bridges, on coupling with nalidixic acid, and additional reticulation, in reactions with nitrofural.

The same observations are to be made when determining the rheological behaviour by static axial stresses on fibers with loads of 1 and 2 cN/fb. The loads belong to the elastic domain.

The experimental values obtained are listed in Table 4.

It is observed that the elastic instantaneous (ε_1) and delayed (ε_2) deformations increase with increasing the amount of coupled nalidixic acid (more pronounced increase at ε_2) while the plastic remanent deformation ε_2, decreases in the same direction.

The same tendency is manifested, too, by the degree of elasticity and rate of recovery, for both batches of samples.

3. Conclusions. The physico-mechanical and rheological characteristics determined for chemically-modified PVA fibers evidence modifications in the fibers supramolecular structure.

The deviation of the parameters values for the chemically modified fibers., as compared with the reference samples, are low, so that one may draw the conclusion that the fibers will behave well in mechanical processes of thread spinning and then in weaving mills or knitted goods production.

Table 4
Rheological Behaviour of the Analyzed Fibers

Sample no.	P_s, cN/fb	Total deformation, [mm]	ε_1, %	ε_2, %	ε_3, %	Degree of elast., [%]	Recovery rate, [mm/min]
Reference	1	2.2	46.7	28.3	25.0	75.0	5.0
	2	3.0	40.0	27.0	33.0	70.0	4.6
1	1	2.3	46.9	30.2	22.9	74.2	4.8
	2	3.2	41.4	27.8	31.7	71.1	4.3
2	1	2.5	47.2	31.8	21.3	72.8	4.4
	2	3.5	41.9	28.4	30.2	70.3	4.0
3	1	2.6	47.4	32.4	20.8	71.4	3.9
	2	3.7	42.4	29.0	28.6	68.6	3.3
4	1	2.8	47.8	33.1	19.5	67.1	3.6
	2	3.8	42.8	29.6	27.3	65.5	3.1
5	1	3.2	48.2	35.0	18.4	65.9	3.2
	2	3.9	43.3	30.4	26.5	62.3	2.7
6	1	2.0	45.8	27.9	25.8	75.6	5.2
	2	2.9	40.6	25.1	31.3	74.1	4.9
7	1	1.8	44.2	26.5	28.3	76.8	5.5
	2	2.6	39.2	24.0	34.1	75.4	5.1
8	1	1.5	43.1	25.3	31.0	78.0	5.8
	2	2.2	38.4	21.2	37.8	76.1	5.4
9	1	1.3	42.7	24.8	43.2	79.9	6.3
	2	2.0	37.3	20.9	40.1	77.5	5.7
10	1	1.2	41.6	23.7	37.0	81.3	6.9
	2	1.8	36.5	19.7	42.8	88.8	6.0

Polymer-analogous reaction on partially soluble PVA fibers determine their increased insolubility.

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COMPORTAREA FIZICO-MECANICĂ ŞI REOLOGICĂ A FIBRELOR POLIALCOOLVINILICE MODIFICATE CHIMIC

(Rezumat)

Au fost experimentate comportările fizico-mecanice şi reologice a fibrelor polialcoolvinilice modificate chimic, în raport cu fibrele martor. S-au determinat parametrii: higroscopicitate, finețe, ondulații, parametri din curbele sarcină–deformație, deformațiile elastice instantanee, întârziată, plastică remanentă şi sunt relevate modificările în structura fibrelor.

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THE THERMAL BEHAVIOUR OF SOME POLYESTER BASED FABRICS

BY
PULFERIA NICOLAIOV, ELENA MIHAI,
ADRIANA JUMUGA and LUCIA ODOCHIAN

1. Introduction. The chemical physical and morphological structure of fibrous textiles explains their chemical and physico-mechanical properties, as well as their behaviour during processing.

Fibers represent an assembly of filiform macromolecules in various morphological forms having a biphasic structure, with amorphous and mesomorphons regions. The ratio between the regions of the fibers biphasic structure determines their thermostability, limit of elasticity, yield, permeability to gases, vapors and liquids – all of them defining properties of the textiles behaviour during processing and wearing.

In finishing–working processes, as well as during their exploitation, textile materials are subjected to heat which, almost always, modifies their physico-mechanical and chemical properties and in some cases, even destroys them.

Heat's destructive effect depends on the fibrous composition and structure of textiles, as well as on their duration and medium in which they act.

In various phases of the confections fabrication processes the raw material employed is subjected to a series of modifications, the mechanisms and effects of which differ under different conditions of the large diversity of the textiles density values. In this respect, special problems are created by the multi-compound mixtures and by the large variety of the new chemical fibers.

Nowadays the rapid increase of automatization and robotization in this industrial branch requires thorough knowledge on the textiles thermal behaviour for further development of optimal programs for their processing [1]...[4]. Thus in mechanical processing of cutting and serving the heat developed as a consequence of the frictions appearing between the material and the working equipments should not exceed the values accepted from the viewpoint of the textiles quality. Knowledge of their thermal behaviour will undoubtedly contribute to solving this problem both by the adaption of the optimal technological parameters and by providing the machines with cooling systems. Within thermowelding processes the thermal conditions applied are essential as to the product's subsequent properties. Thus the process of humido-thermal finishing represents a quite complex phenomenon (umectation, pressing and drying), as heating of the textile materials induces splitting of certain intermolecular bonds within the fibers, removal of the latent tensions in the fibers and tissues migrations of vapors and of the condense too, balancing of the humidity content, influencing, too, some aesthetical properties of the finite product, such as shape, form color, shade, harmony.

On having in view all these considerations, the present paper is devoted to the study of the thermal behaviour of some polyester based fabrics, with more and more extended applications everywhere, as due to both their multiple qualities and special textile characteristics, evidenced especially when processed according to a new, highly suitable method in mixtures with cotton, wool, liberian fibers and other chemical fibers.

2. Experimental. For the characterization of the thermal behaviour of some polyester-based fabrics, 11 samples have been taken into study, 5 of them containing only one compound representing a part of the samples with several compounds, 3 samples with 2 compounds and 3 samples with 3 compounds.

The method of investigation applied is based on thermogravimetry under dynamic conditions of temperature [5], on using a P a u l i k – P a u l i k – E r d e y type derivatograph with simultaneous recording of the thermogravimetric (*TG*), derived thermogravimetric (*DTG*), thermal differential (*DTA*) and temperature (*T*) curves. For the obtainment of comparable data, the same conditions for thermograms recording have been observed, namely: heating rate, 12°/min, maximum temperature attained 600°C, weight of the sample 20 mg, reference material Al_2O_3 calcined at 1000°C, natural environmental conditions, *DTG* and *DTA* sensibility.

3. Results and discussion. Figures 1,...,5 exemplify the thermograms of several fabrics, with only one compound (Figs. 1, 2), with two compounds (Fig. 3) and with three compounds, respectively (Figs. 4, 5), evidencing the specific character of the process of thermal degradation.

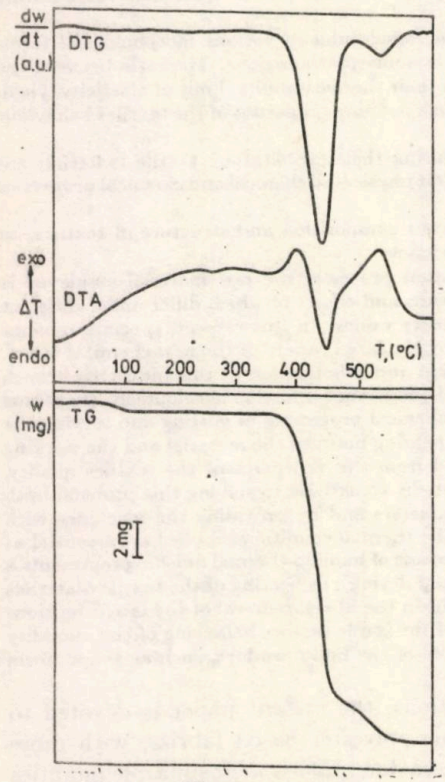

Fig. 1.– Thermogram of 100% polyester fabric.

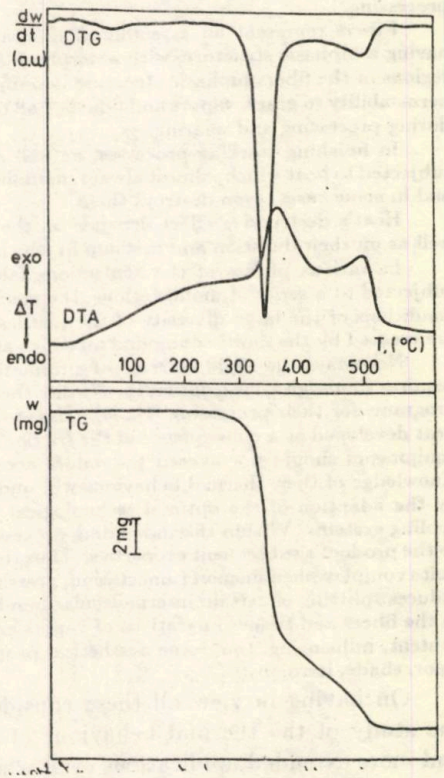

Fig. 2.– Thermogram of 100% cotton fabric.

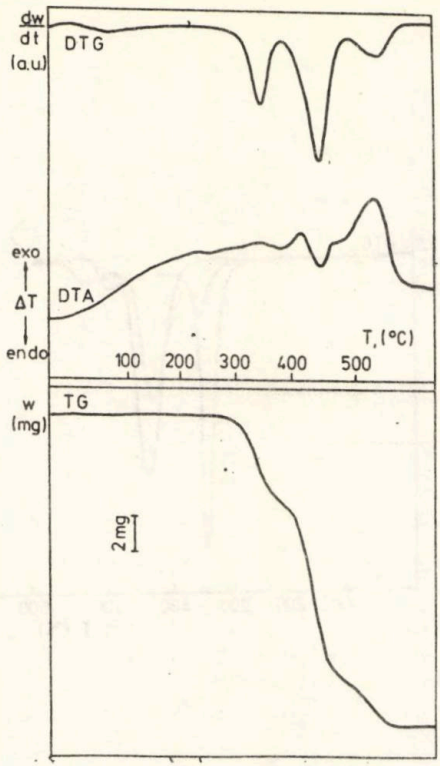

Fig. 3.– Thermogram of 80% polyester and 20% wool fabric.

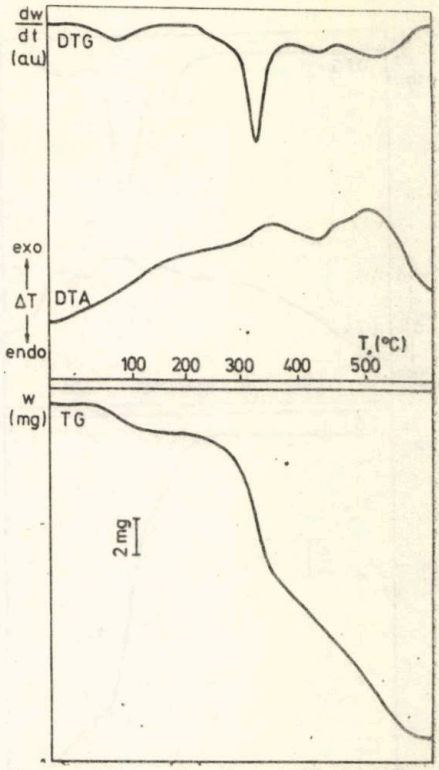

Fig. 4.– Thermogram of 20% polyester, 45% melana and 35% wool fabric.

The degradation mechanism of the studied samples is quite complex, being developed in successive reactions influenced both by the nature of the polymeric fiber [6], [7] and by that of the natural fiber employed [8],...,[10]: it is evidenced by the aspect of the *DTG* and *TG* curves, having several peaks and correspondingly several degradation steps.

The thermogravimetric values characterizing the fabrics, namely: T_1 – initial degradation temperature, T_m – temperature corresponding to the maximum degradation rate, T_f – final degradation temperature and W_∞ – weight loss expressed as percents for the steps of thermal degradation separated from the *DTG* curves, are presented in Table 1 for fabrics with only one compound and in Table 2, respectively, for those with two and three compounds.

Data in Table 1 show that the stage corresponding to the 20-160°C temperature domain expresses the elimination of waters retained in the fabric; the observation to be made is that both the polyester and melana are hydrophobic. The highest content of humidity is met with rayon pulp, therefore it is the most hydrophobic compound resulted from the weight loss in percent values corresponding to the first stage ($W_{\infty 1}$%).

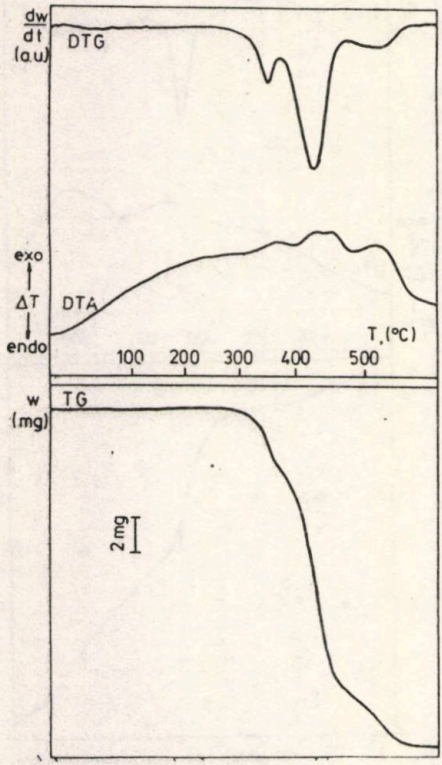

Fig. 5.– Thermogram of 66% polyester, 51% cotton and 3% paraffin.

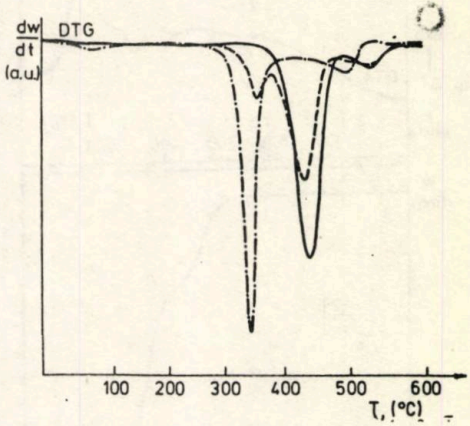

Fig. 6.– Derived thermogravimetric curves of 100% polyester fabrics (——); 100% cotton (– · – · –) and 67% polyester, 31% cotton, 2% paraffin (– – –).

As to the thermostability of the studied fabrics, containing only one compound, comparison of the initial degradation temperatures and of the temperatures at maximum degradation rates evidences the following series of thermostability values: sample *1* > sample *2* > sample *4* > sample *5* > sample *3* (wool is the most thermally unstable compound, while the polyester – the most stable thermally).

Table 2 listing the thermogravimetric values characterizing fabrics wade of 2 and 3 compounds shows that, usually humidity corresponds to the ratio with which the hydroscopic compound enters the mixture (for example: sample *11* in which cotton represents 31%, has a theoretical humidity value of 0.80%, its experimental value being of 1%).

With reference to thermostability the observation is made that the initial degradation temperature in multi-compound textiles depends on the lowest thermally stable compound, as expected actually; its values are sometimes modified, especially when no satisfactory separation of the compounds occurs (samples *9* and *10*). Therefore in the case of multi-compound fabrics the following series of ther-

Table 1

Thermogravimetric Parameters Characterizing Fabrics with Only One Compound

No.	Sample	Stage I				Stage II			
		T_i [°C]	T_m [°C]	T_f [°C]	W_∞ [%]	T_i [°C]	T_m [°C]	T_f [°C]	W_∞ [%]
1.	Polyester 100%	–	–	–	–	330	439	481	89.48
2.	Melana 100%	–	–	–	–	280	340	360	8.10
3.	Wool 100%	20	61	161	11.5	176	293	450	56.0
4.	Cotton 100%	40	61	141	3.37	250	350	410	76.83
5.	Rayon pulp 100%	25	80	155	12.37	255	325	404	67.42

No.	Stage III				Stage IV			
	T_i [°C]	T_m [°C]	T_f [°C]	W_∞ [%]	T_i [°C]	T_m [°C]	T_f [°C]	W_∞ [%]
1.	481	528	570	10.52	–	–	–	–
2.	360	380	455	58.94	464	615	715	32
3.	450	540	630	32.5	–	–	–	–
4.	430	500	520	19.8	–	–	–	–
5.	412	478	510	20.21	–	–	–	–

mostability values will be most: sample *11* > sample *8* > sample *7* > sample *10* > sample *9* > sample *6*.

Checking of the thermostability values involved calculation of the activation energies for the first stage of thermal degradation, by the Freeman-Carroll method [11] (s. Table 3).

It has been observed that the activation energies in the case of multi-compound fabrics – correspond to the first process of thermal degradation of the lowest thermally stable compound, when the processes are will – separated or similar, in the case of samples with no well separated degradation domains, usually tricompound fabrics, the same series of thermostability values resulting.

When the degradation of pure compounds takes place within different temperature domains, in the case of multi-compound fabrics there are to be met the stages characterizing the fabrics made of only one compound; also, the corresponding weight losses show that they reflect the compounds composition, which might constitute a method for the establishment of the textile fabrics composition.

A good example in this respect is sample *11* (polyester 67% + cotton 31% + parafin 2%) whose thermogram superposed on that of cotton and polyester (Fig. 6) permits the conclusion that the peaks corresponding to the two major compounds (cotton and polyester) are not superposed, while the weight losses composition (s. Table 2).

If the pure compounds degradation stages are superposed, the weight losses have no significance in this respect.

4. Conclusion. The obtained results permit:

– the establishment of the textiles humidity;

– the characterization of the textiles thermal behaviour, the initial degrada-

Table 2

Thermogravimetric Parameters Characterizing Multicompound Fabrics

No.	Sample	Stage I				Stage II			
		T_i [°C]	T_m [°C]	T_f [°C]	W_∞ [%]	T_i [°C]	T_m [°C]	T_f [°C]	W_∞ [%]
6.	Polyester 80% + Wool 20%	25	64	120	4.16	200	340	373	20
7.	Polyester 67% + Cotton 33%	30	68	151	4.64	240	349	405	30.3
8.	Polyester 60% + Liberian fibres 40%	20	65	118	3.65	243	339	370	30.0
9.	Polyester 20% + Melana 45% + Wool 35%	20	75	158	7.86	210	330	384	48.35
10.	Polyester 33.3% + Melana 33.3% + Rayon pulp 33.3%	20	52	128	2.60	220	331	390	34.9
11.	Polyester 76% + Cotton 31% + Parafin 2%	30	68	151	1.00	250	350	370	31.3

No.	Stage III				Stage IV			
	T_i [°C]	T_m [°C]	T_f [°C]	W_∞ [%]	T_i [°C]	T_m [°C]	T_f [°C]	W_∞ [%]
6.	373	435	480	70.8	480	528	560	5.04
7.	440	493	540	52.0	481	520	560	17.7
8.	370	439	479	56.80	480	519	566	13.02
9.	348	424	455	17.97	455	510	580	25.84
10.	390	410	452	50.0	452	591	600	12.5
11.	370	428	469	52.9	481	520	560	14.8

tion temperatures indicating the maximum temperatures that may be attained in finishing–working processes;

– the application of thermogravimetric analysis in dynamic conditions of temperature as a method for establishing the composition of multi-compound fabrics

Table 3

Activation Energy for Stage I of Thermal Degradation

No.	Sample	Activation energy (E_a, [kJ])
1.	Polyester 100%	238.76
2.	Melana 100%	213.18
3.	Wool 100%	133.76
4.	Cotton 100%	175,97
5.	Rayon pulp 100%	145.63
6.	Polyester 80% + Wool 20%	163.77
7.	Polyester 67% + Cotton 33%	171.92
8.	Polyester 67% + Liberian fibres 33%	109.55
9.	Polyester 20% + Wool 45% + Melana 35%	137.50
10.	Polyester 33.3% + Rayon pulp 33.3% + Melana 33.3%	184.88
11.	Polyester 67% + Cotton 31% + Parafin 2%	176.85

in which the degradation of pure compounds occurs within various temperature domains.

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COMPORTAREA TERMICĂ A UNOR ŢESĂTURI PE BAZĂ DE POLIESTER

(Rezumat)

S-a studiat comportarea termică a unor ţesături pe bază de poliester utilizând termogravimetria în condiţii dinamice de temperatură, ceea ce permite înregistrarea simultană a curbelor:

termogravimetrice (TG), termogravimetrice derivate (DTG) şi termice diferenţiale (DTA).

Metodele termice permit stabilirea umidităţii materialelor textile, a temperaturilor maxime care pot fi atinse în procesele de prelucrare–finisare şi a compoziţiei ţesăturilor cu mai mulţi componenţi, la care degradarea componenţilor puri are loc în domenii diferite de temperatură.

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Secţia VIII
TEXTILE. PIELĂRIE

RESEARCHES CONCERNING THE INFLUENCE OF THE TRASH OF THE COTTON FIBRES UPON THE CHARACTERISTICS OF THE ROTOR–SPUN YARNS

BY

DEMETRA BORDEIANU, MARIANA NECULĂIASA and VALERIA GRIBINCEA

1. Introduction. At present, it is unanimously accepted that the properties of the cotton fibres influence rotor–spinning and implicitly the characteristics of the yarns obtained on these machines, but the order of their importance is other than in the case of ring–spinning.

It is known that rotor–spinning is very vulnerable concerning the threads breaking caused by different categories of trash which can produce rotor deposits with repercussions on the quality of the obtained yarns, too.

Starting from this idea, in the present paper we have tried to give emphasis to the influence of the trash content from the sliver supplied at the spinning–rotor machines BD 200 RC upon the characteristics of the obtained yarns.

With this end in view, the sliver was supplied with a content of trash of 1.2%, 1.09% and 0.9%, respectively of which Nm 27, Nm 34 and Nm 40 yarns were made.

It is to be mentioned that in order to decrease the influence of other factors upon the characteristics of the studied yarns, 100% 2A Russian cotton was used. Spinning was performed in the same conditions, with a revolution of the opening roller of 7,000 rev/min and a revolution of the rotor of 36,000 rev/min.

2. Results and interpretations. The principal properties of the produced yarns are shown in Table 1 and graphically represented in Figs. 1,...,4.

The graphic presented in Fig. 1 shows the influence of the trash from the supplied sliver upon the uniformity on short portions ($U\%$) of the yarns.

The presence of the trash in the rotor causes its unbalancing, fact which leads to a variation of the linear density with short wave length and implicitly an increase of the uniformity on short portions. The well-known "moar" effect can appear a fault characteristic to the rotor-spun yarns.

The yarn irregularity and the frequency of imperfections as measured on Uster equipment increase with the increasing on trash.

Table 1

The Effect of Trash upon the Properties of the Yarn Produced

Properties of yarn	Nm 27			Nm 34			Nm 40		
	V_1	V_2	V_3	V_1	V_2	V_3	V_1	V_2	V_3
Trash in sliver %	1.2	1.09	0.9	1.2	1.09	0.9	1.2	1.09	0.9
Trash in yarn %	0.45	0.37	0.48	0.33	0.26	0.46	0.46	0.32	0.22
Yarn irregularity %	5.767	2.615	1.403	4.957	3.081	1.039	4.169	2.896	1.593
Yarn breaking strength (cN)	333.713	339.7	342	254.1	260.186	269.184	206.59	224.13	241.37
C_v of yarn breaking strength (%)	10.881	10.401	9.741	11.49	11.31	10.319	12.77	12.56	9.91
Yarn tenacity (cN/tex)	9.01	9.17	9.23	8.64	8.84	9.15	8.26	8.96	9.654
U (%)	12.44	11.3	10.18	12.54	11.58	11	13.42	12.86	11.44
Thin places/1000 m	28.8	8	3.2	17.6	11.2	11.2	75.6	22.4	22.4
Thick places/1000 m	41.6	22.4	8	43.2	17.6	20.4	91.2	57.6	22.4
Neps/1000 m	11.2	17.6	9.6	22.4	24	20.4	89.6	51.2	49.6
Extension of break (%)	6.065	5.456	5.639	5.328	5.096	4.986	4.849	4.48	4.613

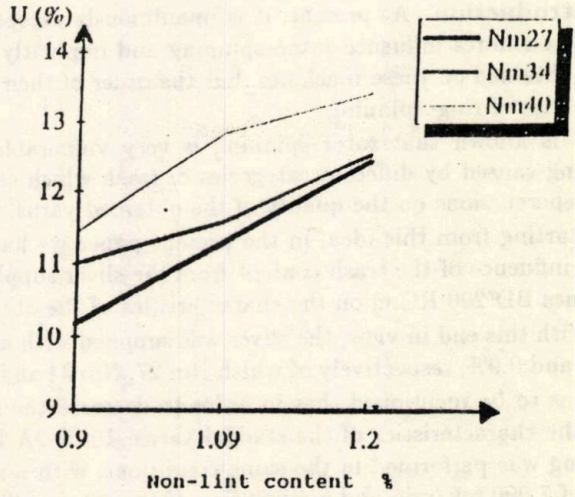

Fig. 1.– Effect of the trash upon short-term uniformity (Uster) of rotor-spun yarns.

Fig. 2 presents the results obtained when measuring the yarn-irregularities on protions of 100 m of yarn (long-term irregularity). Figs. 3 and 4 reveal the influence of the transh upon the tenacity and irregulaty of yarn breaking, a phenomenon which can be understood through the increase of the linear density trash in the yarn.

3. Conclusions. The content of trash deeply affects the irregularity of the linear density an short-term as well as on long-term.

The increase of the irregularity is reflected in the mechanical characteristics of the yarns through a reduction of the average value of the tenacity and through

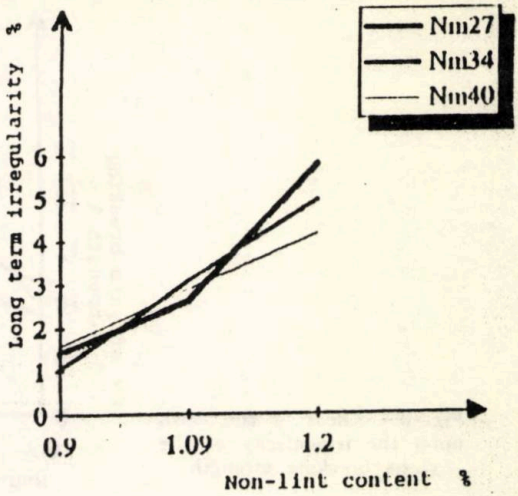

Fig. 2.– Effect of the trash upon long-term uniformity of yarns.

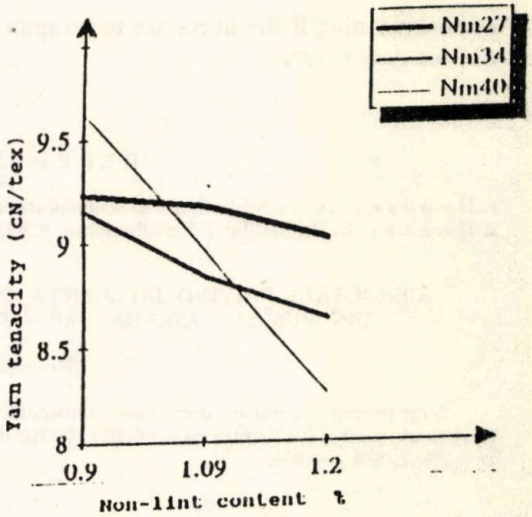

Fig. 3.– Effect of the trash upon the yarns tenacity.

the increase of the variation coefficient of this.

Correct selection of the raw material is therefore essential for a significant increase in yarn strength (rotor-spun yarns are not so sensitive to twist as ring-spun yarns).

Higher trash content can also cause a determination in spinning performance, ends-down and yarn properties. The rotors need only be cleaned more than the

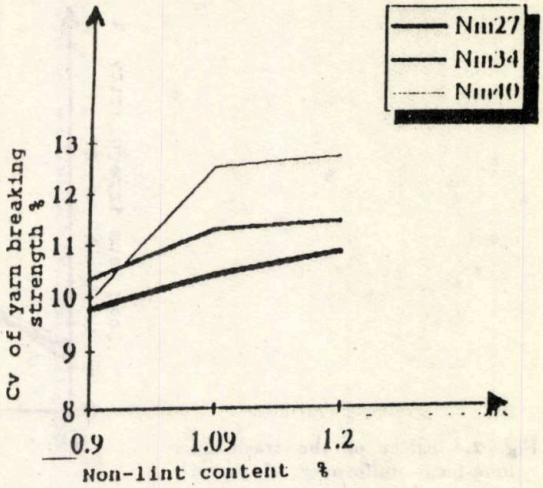

Fig. 4.– Effect of the trash upon the irregularity of the yarns breaking strength.

normal cleaning if the fibres are to be spun successfully.

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CERCETĂRI PRIVIND INFLUENŢA CONŢINUTULUI DE IMPURITĂŢI DIN BUMBAC ASUPRA CARACTERISTICILOR FIRELOR OE

(Rezumat)

Sunt prezentate unele caracteristici tensionale şi de aspect ale firelor Nm 27, Nm 34 şi Nm 40 obţinute pe maşina de filat cu rotor BD 200 RC din benzi de bumbac cu conţinut de impurităţi de 1,2%; 1,09% şi 0,9%.

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TEXTILE. PIELĂRIE

DEVICE FOR THE SELECTION OF THE COMPOUND NEEDLES ON AUTOMATIC FLAT KNITTING MACHINES

BY

MIRCEA MATEESCU, LILIANA TOADERE and STELIAN FILIPESCU

1. General Elements. The different movements of the compound needles elements (the hook element and the closing element) involve the projection of the elements butts from the needle trick, after selection, in one of these positions *o*, *s*, *i*. For selection, as a rule, pressing cams are used. That means that besides the up and down movement there is, also, an oscillating movement of the needles elements in the needle tricks, which disturbs the knockover and the new stitch formation phase.

In the literature it is mentioned a patent from Shima S e i k i related to a knitran system for automatic flat knitting machines with electronic selection of the needles, using compound needles [1].

This paper presents a device for the selection of the compound needles at automatic flat knitting machines, device which is the object of the patent Romania *100796* [2].

The main advantages of this device are:

– the stitch forming elements (selectors, slider jacks, jacks) have only up and down movements;

– the way of projection of the jacks butts in one of the positions *o*, *s*, *i* is easier and eliminates the bending of the elements;

– the pressing cams are replaced by selection blocks with cams situated on eight levels; that enables the projection of the butts in three positions *o*, *s*, *i* after only one selection.

2. Device for the Selection of the Compound Needles. The device, presented in Fig. 1, consists of two selection blocks B_1 and B_2 (Fig. 1 *d*) with the cams (*26.a,b*) situated on eight levels; the positions of these cams are electromagnetically controlled by an electronic device which generates synchronized impulses, in a certain order. At the same selection the selectors (*21*) are selected on three different levels, that means the positioning of the butts (*6*) and (*7*) in *o*, *s* or *i* position (Fig. 1 *a, b, c*).

The jacks (*8*) and (*9*), which have the butts in *o* position, are not put into the action by the knitting and the stitch cams and that means the lack of the old

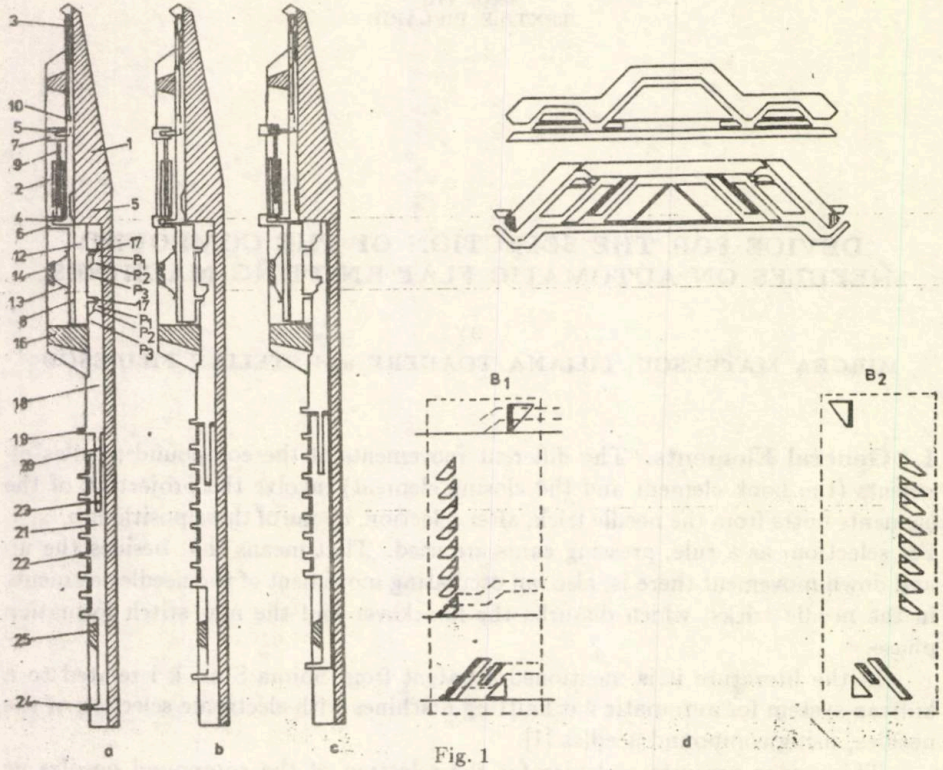

Fig. 1

stitches reknockingover.

In Fig. 1 *a, b, c* three cross-sections at the knitting head are presented showing the stitch forming elements in relative position; the butts of the jecks which correspond to the hook and closing element are in position *o*, *s* or *i*. Fig. 1 *d* shows the cams of the knitran system and the selection blocks for a single system automatic flat knitting machine using compound needles with laterally extended rib loop transfer spring on the closing element [3].

The compound needles are arranged in the needle tricks (*1*) (Fig. 1 *a, b, c*). They consist of the hook element (*2*) and the closing element (*3*); the coupling butts (*4*) and (*5*) enable the movement of the elements (*2*) and (*3*) by the butts (*6*) and (*7*) of the jacks (*8*) and (*9*). The compound needles are maintained in the needle tricks by the verge (*10*).

By selection, the butts (*6*) and (*7*) of the jacks (*8*) and (*9*) can have three positions: *o* (Fig. 1 *a*), *s* (Fig. 1 *b*), or *i* (Fig. 1 *c*). The jack (*8*), corresponding to the hook element (*2*), has holding arm (*11*) which guides and holds permanently the jack (*9*), corresponding to the closing element (*3*).

The jacks (*8*) are maintained permanently in contact with the forks (*12*) by the springs (*13*), which are fixed with the verge (*14*). The shoulder (*15*) and the

verge (*16*) guide the fork (*12*) up and down, along the vertical line. The forks (*12*) have two butts (*17*) which are sustained by the slider jacks (*18*), through a pair of thresholds p_1, p_2, p_3.

After selection, the threshoulds p_1, p_2, p_3 enable the vertical movement of the fork (*12*) that means the positioning of the butts (*6*) and (*7*) (by the holding arm *11*) in *o*, *s* or *i* positions. The slider jack (*18*) has a butt (*19*) for cancelling the selection and a profile (*20*) which guides the selector (*21*). Each of the selectors *21* have one butt (*22*), situated at one of those eight levels, a cut (*23*) and an working butt (*24*) for the achievement of the selection.

The verges (*16*) and (*25*) maintain the slider jack (*18*) and the selector (*21*) in the needle tricks. The hook element (*2*) and the closing element (*3*) are selected by a knitran system with cams situated at two levels [4], [5], indirectly, through the butts (*6*) and (*7*) of the jacks (*8*) and (*9*).

The selection blocks for the electronic selection have two modules B_1 and B_2 (Fig. 1 *d*). These modules consist of the mobile cams (*26*), which have two steps (*26.a*) and (*26.b*) and can move the butts (*22*).

Fig. 2 presents a section through the needle tricks (*1*) and the three positions which can be occupied by the cam (*26*) when actioning the butt (*22*) of the selector (*21*).

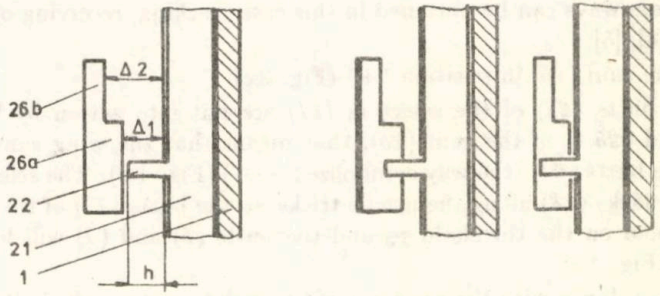

Fig. 2

After the selection through the cams (*26*) (Fig. 2) the butts (*24*) of the selectors (*21*) are positioned at three levels (Fig. 1 *a*, *b*, *c*) that means:

a) – the maintaining of the butts (*24*) under the action level of the cam (*27*);

b) – the placing of the butts (*24*) at the action level of the cam (*27*);

c) – the placing of the butts (*24*) at the action level of the wing cam (*28*).

The wing cams (*29*) and (*30*) cancel the selection behind the knitting system, through the going off of the slider jacks (*18*) and selectors (*21*) in the positions shown in Fig. 1 *a*.

The selection made by cams (*26*) at those eight levels means the achievement of the three positions (shown in Fig. 1 *a*, *b*, *c*) with only one of the modules of the selection blocks (B_1):

1°The cam (*26*) in position "–" (Fig. 2 *a*):

The butts (*22*) of the selectors (*21*) are not put into action, that means that the working butts (*24*) have the way symbolized with (——) (Fig. 1 *d*). Therefore, the slider jacks (*18*) remain unmoved, the butts (*17*) of the forks (*12*) remain sustained on the threshold p_1 and the butts (*6*) and (*7*) of the jacks (*8*) and (*9*) are situated in *o* position (Fig. 1 *a*).

This position means the way for missing without the re-knockingover of the old stitches.

2°The cam (*26*) in position "|" (Fig. 2 *b*):

The butts (*22*) of the selectors (*21*) are put into action only by the step (*26.a*) of the cam (*26*), that means that the cam (*27*) puts into action the butts (*24*) (the way symbolized (– – –) (Fig. 1 *d*).

The selectors (*21*) move the slider jacks (*18*) along the needle tricks, so the butts (*17*) of the forks (*12*) will be sustained on the threshold p_2 and the butts (*6*) and (*7*) will be situated in *s* position (Fig. 1 *b*).

In accordance with the positions of the mobile cams in the knitran system, one of these ways can be obtained in this case: tucking, receiving or receiving and knitting [4], [5].

3°The cam (*26*) in position "+" (Fig. 2 *c*):

The butts (*22*) of the selectors (*21*) are put into action by both the steps (*26.a*) and (*26.b*) of the cam (*26*), that means that the wing cam (*28*) put into action the butts (*24*) (the way symbolized –·–·–) (Fig. 1 *d*). The selector (*21*) move the slider jacks (*18*) along the needle tricks, so the butts (*17*) of the forks (*12*) will be sustained on the threshold p_3 and the butts (*6*) and (*7*) will be situated in *i* position (Fig. 1 *c*).

In accordance with the positions of the mobile cams in the knitran system one of these ways can be obtained: knitting or transferring [4], [5].

3. Conclusions. Because of the action of the cams in the electronic selection blocks three ways for the butts (*22*) and (*24*), can be obtained after only one selection that means, through the slider jack, fork and jack, three positions for the butts (*6*) and (*7*): *o*, *s* or *i*.

In accordance with the positions of the mobile cams in the knitran system can be obtained:

– three ways for knitting: missing without re-knockingover of the old stitches, tucking, knitting;

– three ways for transfer: missing without re-knockingover of the old stitches, receiving, transfer;

– receiving and knitting.

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INSTALAŢIE DE SELECTARE A ACELOR CU ZĂVOR LA MAŞINI RECTILINII DE TRICOTAT AUTOMATE

(Rezumat)

Instalaţia de selectare a acelor cu zăvor la maşinile rectilinii de tricotat automate prezentată în această lucrare este compusă din două blocuri se selectare cu came situate la opt nivele, poziţiile lor fiind comandate electromagnetic de la o instalaţie electronică. Astfel, într-o singură etapă de selectare se pot obţine trei traiectorii pentru călcâiele desenatoare, respectiv călcâiele de lucru ale selectorilor, ceea ce determină în continuare situarea călcâielor de acţionare ale acelor în trei poziţii *o*, *s* sau *i*.

Funcţie de poziţiile camelor mobile ale lacătului integrat, se pot obţine: trei traiectorii la tricotare, trei traiectorii la transfer şi o traiectorie pentru transfer (primire) şi tricotare.

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TEXTILE. PIELĂRIE

A NEW APPROACH TO YARN-TO-NEEDLE FRICTION

BY
RADKO KOVAR

1. Introduction When the textile yarn moves over the small diameter friction surfaces, the yarn tension increases considerably. This phenomenon is usually described by E u l e r's formula or derivates of this relation, which are summarized, for example, by K o w a l s k i [1]. The reason for yarn tension increasing is friction, described by friction coefficient, f. A valuee of this coefficient changes in relations with the properties of the investigated yarn, geometry and surface quality of the friction area, depends on the yarn speed, climatic conditions, etc.

Another view to this phenomenon can be offered. When moving over a small diameter friction surface, the yarn is bending and straightening again. The real diameter of deformed yarn axis is small and it often can be compared with the yarn diameter itself. Bending deformation of the yarn cannot be fully elastic, what means that bending and straightening of the yarn bring about considerable energetical losses. The compensation of this lost energy can be brought to the friction place only by increasing the yarn output tension. Other energetical losses are caused by deformation of cross-section of the yarn.

Outwardly it looks like increasing of the friction coefficient value. The total energy loss is proportioned to the difference between the output and input yarn tension and to the speed of yarn motion. The main aim, next briefly described, is the experiments in order to determine the share of the yarn deformation energy losses and friction of the yarn over the knitting needle surface itself on the increasing of the yarn tension.

2. Experimental. As it already been told, the addition of the yarn tension may be caused both by friction and by deformation of the yarn. To compare these two influences it was necessary to experimentally eliminate at least one of them. The principales of experiments we used are shown in Fig. 1 a, b.

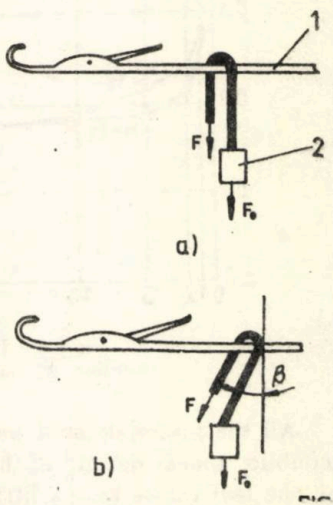

Fig. 1.– Measuring friction yarn properties.

1.*a* – output yarn tension F was measured when the yarn started to move. The input tension F_0 was kept by weight 2 in the scale 1, 2, 5, 10, 20, 50 mN (0.1; 0.2; 0.5; 1; 2; 5 grams). The yarn was led over the needle stalks 1 with a total angle of contact $\alpha = \pi$ ($\alpha = 180°$).

1.*b* – the yarn loop is kept by the needle stalk 1 and loaded by weight 2. An angle β was measured when setting the yarn into motion. In this case the yarn does not change the form and its deformation has no influence on the result. The *pure* friction can be thus measured when a relation $f_2 = \tan\beta$ is valid.

The diameter of used knitting needle was 0.40 mm.

Both experiments were compared using E u l e r's formula $F = F_0 \exp(\alpha \cdot f_1)$. Friction coefficients f_1, f_2 were considerably different, greater f_1 includes, besides friction, an influence of the bending rigidity, deformation of cross-section of the yarn, etc.

To eliminate an accidental influence 34 different yarns [2], [3] were mesured, each of them at 6 different values of F_0 and all the experiments were repeated 10 times. The results are in very good agreement with non-linear regression, so it is not necessary to reproduce all the outcome. Table 1 shows the main parameters of regression relations A, B, C and corelation coefficient R for both experiments.

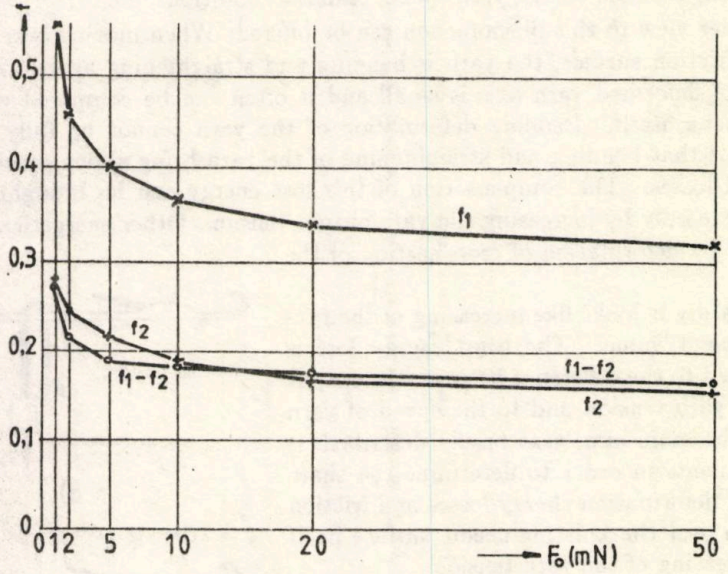

Fig. 2.– Dependencies between input yarn tension F_0 and friction coefficients f_{1*} and f_{2*}.

All the materials used were obtained from different knitting mills in Czech Republic. Linear density of the yarns, introduced in the next review, is theoretical, the real values were a little different. The data about yarn preparation were

Table 1

Yarn	$f_1 = AF_0^B + c$				$f_2 = AF_0^B + c$			
num.	A	B	C	R	A	B	C	R
1	0.27	-0.55	0.33	0.99	0.26	-0.22	0.10	0.99
2	0.31	-0.68	0.29	0.99	0.19	-0.33	0.14	0.99
3	0.47	-0.36	0.25	0.96	0.12	-0.41	0.16	0.97
4	0.19	-0.63	0.30	0.97	0.14	-0.51	0.15	1.00
5	0.22	-0.81	0.33	1.00	0.11	-0.24	0.12	1.00
6	0.23	-0.89	0.29	0.98	0.14	-0.44	0.14	0.98
7	0.21	-0.76	0.31	1.00	0.19	-0.26	0.13	0.99
8	0.21	-0.59	0.23	0.99	0.13	-0.43	0.14	0.98
9	0.47	-0.78	0.29	0.99	0.16	-0.53	0.11	0.98
10	0.27	-0.49	0.30	0.99	0.16	-0.43	0.10	1.98
11	0.26	-0.54	0.24	0.99	0.25	-0.17	0.00	0.98
12	0.23	-0.78	0.29	0.97	0.24	-0.16	0.00	1.00
13	0.33	-0.42	0.24	0.98	0.20	-0.41	0.11	1.00
14	0.20	-0.77	0.26	0.99	0.15	-0.22	0.09	0.98
15	0.22	-0.36	0.24	0.97	0.19	-0.35	0.12	0.99
16	0.16	-0.24	0.28	0.98	0.15	-0.77	0.14	0.98
17	0.40	-0.10	0.13	1.00	0.80	-0.59	0.16	0.98
18	0.35	-0.70	0.25	0.97	0.15	-0.41	0.09	0.99
19	0.58	-0.12	-0.05	1.00	0.99	-0.31	0.12	1.00
20	0.24	-0.23	0.34	0.98	0.19	-0.23	0.08	0.99
21	0.25	-0.53	0.20	1.00	0.25	-0.21	0.04	1.00
22	0.82	-0.025	-0.40	0.99	0.19	-0.26	0.10	0.99
23	0.11	-0.55	0.32	0.94	0.22	-0.25	0.07	0.99
24	0.33	-0.90	0.31	0.97	0.16	-0.48	0.12	0.98
25	0.22	-0.87	0.28	1.00	0.14	-0.36	0.10	0.96
26	0.18	-0.87	0.29	0.99	0.14	-0.50	0.11	0.99
27	0.32	-0.34	0.28	0.99	0.13	-0.66	0.12	0.98
28	0.56	-0.13	0.02	0.99	0.13	-0.37	0.11	0.99
29	0.19	-0.57	0.23	0.99	0.24	-0.14	0.00	0.98
30	0.24	-0.40	0.30	0.99	0.14	-0.35	0.10	0.98
31	0.44	-0.065	0.00	0.99	0.25	-0.14	0.00	0.99
32	0.16	-0.51	0.30	9.98	0.17	-0.50	0.14	0.99
33	0.27	-0.34	0.30	1.00	0.32	-0.19	0.00	0.99
34	0.34	-0.62	0.29	0.99	0.22	-0.43	0.10	1.00

unknown, so the absolute values of yarn friction coefficients are not comparable. The list of used materials is presented in Table 2.

The average values of friction coefficients from all materials are as follows:

F_0	(mN)	1	2	5	10	20	50
$f_{1\bullet}$	(1)	0.550	0.456	0.400	0.367	0.343	0.321
V_1	(%)	15.3	15.4	15.7	13.1	10.5	11.3
$f_{2\bullet}$	(1)	0.244	0.211	0.185	0.168	0.156	0.151
V_2	(%)	12.3	14.2	15.7	14.4	15.4	14.7
$f_{1\bullet} - f_{2\bullet}$		0.306	0.245	0.215	0.199	0.187	0.170

(V is coefficient of variation)

Table 2
List of Used Materials

Yarn num.	Linear density	Material	Yarn num.	Linear density	Material
1	25 tex x 2	PANs Leacryl	18	67 tex	75 wooll/25 PANs
2	25 tex x 2	PANs Courtelle	19	25 tex x 2	40 PANs/60 PESs
3	25 tex x 2	PANs Totaylon	20	36.5 tex	PESf Hybrifil A
4	25 tex x 2	80 PANs/20 wool	21	17 tex x 2	PESf Slotera
5	25 tex x 2	50 PANs/50 cotton	22	16.7 tex	PESf Slotera
6	25 tex x 2	50 PANs/50 cotton	23	11 tex x 3	PESf Trevira
7	28 tex x 2	80 PANs/18 PESs/2 VSs	24	25 tex x 2	85 PANs/15 VSs
8	27 tex	80 PANs/20 linen	25	26 tex x 2	85 PANs/15 wool
9	28 tex x 2	80 PANs Wolpryla	26	23 tex x 2	50 PANs/50 wool
10	30 tex x 2	PESs HB Velana	27	34 tex x 2	PANs
11	32 tex x 2	wool	28	34 tex x 2	PANs
12	34 tex x 2	80 PANs/20 wool	29	25 tex	PANs
13	21 tex x 2	60 PANs/40 PESs	30	20 tex x 2	PESf Slotera
14	25 tex	cotton (rotor sp.)	31	16.7 tex	PESf Slotera
15	25 tex	78 PANs/6 VSs/16 wool	32	25 tex x 2	PANs
16	36.5 tex	40 PESf/ 60 ACf	33	20 tex x 2	PESf
17	56 tex	47 PADf/53 PESf	34	28 tex x 2	85 PANs/15 PESs

Abbreviations: AC – acetate fibers; PAD – polyamide fibres; PAN – polyacrilic fibres; PES – polyester fibres; VS – viscose fibres; s – staple fibres; f – filament fibres.

Non-linear regression gives the following relations:

$$f_{1\bullet} = 0.254 \quad F_{0-0.531} + 0.29 \quad \text{when} \quad R = 0.999$$
$$f_{2\bullet} = 0.160 \quad F_{0-0.386} + 0.12 \quad R = 0.998$$
$$f_{1\bullet} - f_{2\bullet} = 0.139 \quad F_{0-0.571} + 0.16 \quad R = 0.997$$

3. Discussions. The difference between real friction coefficient f_2 and apparent or illusory friction coefficient f_1 represents addition of output yarn tension, caused by other than friction properties of the yarn.

Under the given experimental conditions, the influence of the bending rigidity and deformation of cross-section on the yarn output tension F is the most responsable circumstance. The beginning of $f_1 - f_2$ curve is very steep. The reason of

these changes are mainly the fact that the curvature of the yarn axis is rapidly increasing in this part. At the low input yarn tension F_0, yarn cannot follow the knitting needle surface and influence of yarn bending rigidity is versatile and not so great. When $F_0 = 10$ mN, the yarn curvature corresponds almost fully to the friction surface diameter and influence of the yarn bending rigidity becomes stabilized. Deformation of the yarn cross-section can change the expression $f_1 - f_2$ even when F_0 is greater than 10 mN, but not too rapidly.

4. Conclusion. The present paper shows that generally used experimental measuring of friction coefficient does not give suitable results for estimating the knitting yarns quality. Diameter of friction surface plays a substantial role in estimating the convenience of the yarns for manufacturing in knitting industry.

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O NOUĂ ABORDARE A FRECĂRII FIR-AC DE TRICOTAT

(Rezumat)

Se prezintă experimentele legate de determinarea tensiunii în fir la trecerea sa peste organe de diametru mic (ex. – ac de tricotat), luând în consideraţie influenţa pierderilor energetice şi a frecării firului în contact cu acul asupra creşterii tensiunii în fir.

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KNITTING SCHEMES OPTIMISATION TO ACHIEVE TRANSFERED STITCH FABRICS

BY
DAN DORIN and MARIANA URSACHE

1. General Considerations. The paper deals with aspects of knitting schemes optimisation to achieve transfered stitch fabrics on one system flat bed knitting machines as well as ways of increasing knitting productivity by reducing the time required in making a panel. This can be achieved by avoiding or reducing the inactive traverses of the carriage.

The knitting machines for which solution are proposed are of Romanian make: one system R11, R12, R50.

The authors take into consideration the posibilities of obtaining knitting and transfer ways, stitch transfer and racking on the above mentioned machines.

The study has been embarked upon achieving the following structures: lacy effects on incomplete wales rib, lacy effects on plain knit and incomplete wales rib. In order to reduce the number of carriage inactive traverses the authors made use of the following technological solutions:

– performing the stitch transfer in the transfer area and knitting the stitches in the knitting systems at the same carriage traverse;

– changing the pattern within low limits without alterig the initial aspect based on the previously mentioned principle.

A coefficient K defined as a ratio between the number of systems required to achieve a structural pattern (SR) and the number of the effective rows resulted within the scheme (h), was used to estimate the reducing the number of traverses to make a row of stitches:

$$K = SR/h. \tag{1}$$

The value of SR is obtain by multiplying the number of traverses required in making the pattern high (Nd) by the number of the machine systems (S).

Relation (1) becomes:

$$K = Nd \cdot S/h. \tag{2}$$

For the one system machines the optimal situation is obtained when $K = 1$.

Value of K is at the bases of comparison among certain selected solutions.

The knowledge of the number of traverses to achieve a row of stiches ($Nd1$) shows significant interest.

Starting from relation (2) one can write:

$$Nd = K \cdot h/S. \tag{3}$$

In relation (3) parametre h is replaced with value 1 (one row) and $Nd1$ parametre is obtained.

The paper presents noneconomical situations currently used in industry as well as optimal solutions recommended to be used in practice.

2. Analysis of the Existing Situation and Improvement of the Solutions. Fig. 1 shows a lacy effect on incomplete wales rib structure.

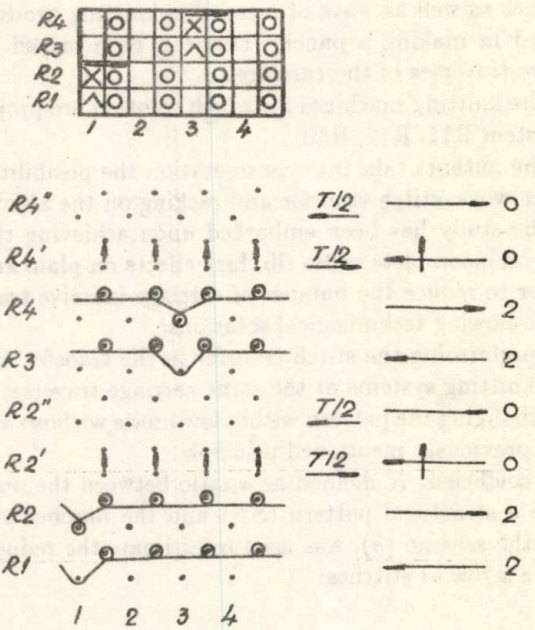

Fig. 1

The assemble formed by a starting loop followed by a normal stitch transfered onto a neighbour needle on the oposite bed makes a hole effect in the fabric.

Within the assembly several starting loops can be associated increasing the lacy effect. These effects can be disposed on the fabric surface according to a pattern in keeping with the selection possibilities on the front bed of the stitch forming mechanism or jacquard ones.

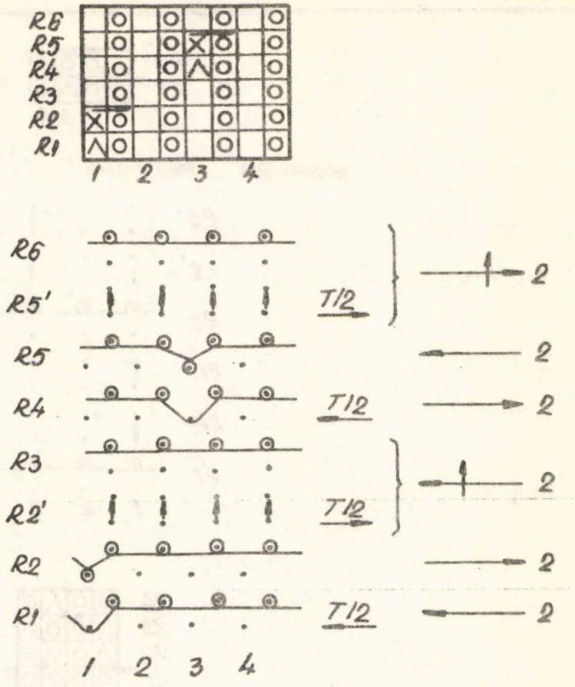

Fig. 2

In the working scheme showed by Fig. 1 transfering and knitting are separately performed on different traverses of the carriage. This solution used in practice comprises two traverses of the carriage for knitting one row of stitches ($Nd1 = 2$; s. Table 1).

Table 1

Fig.	S	Nd	h	k	$Nd1$
1	1	8	4	2	2
2	1	6	6	1	1
3	1	6	2	3	3
4	1	8	4	2	2
5	1	8	4	2	2
6	1	4	4	1	1

Fig. 2 proposes the optimisation of the work scheme through performing knitting and transfering within the same carriage movement. As compared to the drawing in Fig. 1 the aspect in Fig. 2 is slightly changed as between each pare of lacy effects rows, normal stitch rows are introduced.

This improved solution uses one single carriage movement for knitting one row of stitches ($Nd1 = 1$; s. Table 1).

Fig. 3 presents a plain knit structure with lacy effect made on V bed flat knitting machine.

A hole formed by the complete needle loop transfer from a wale onto a neighbour wale on the right or on the left side. The needle from which the transfers were made is maintained at work and in the next cycle it forms a starting loop.

In achieving the lacy effect is used a repeated stitch transfer from one bed to the other with the racking movement of the rear bed.

In order to achieve one row of stitches three carriage traverses are required

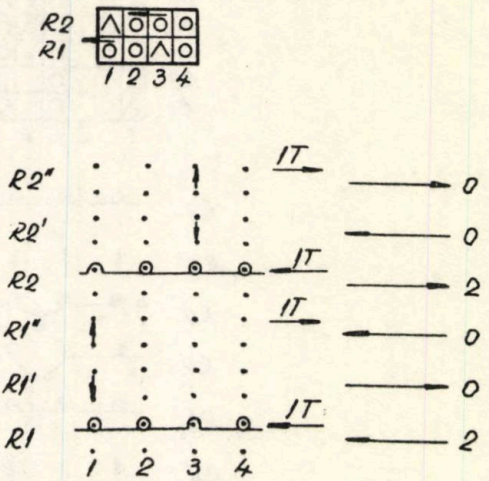

Fig. 3

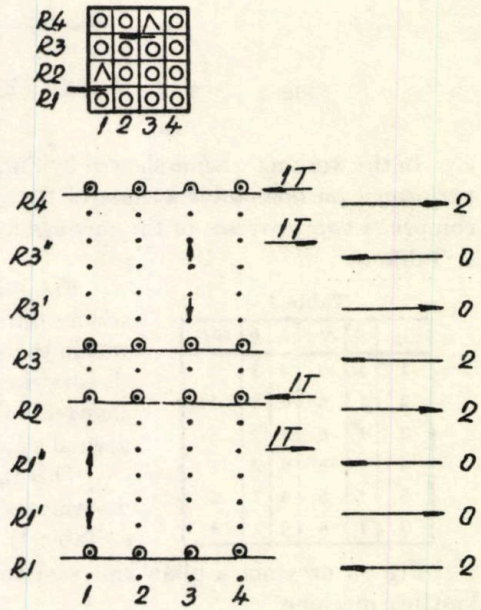

Fig. 4

$l1 = 3$; s. Table 1).

Fig. 4 proposes the optimisation of the working scheme introducing two stitch s between two succesive transfer stages. The aspect of holes is slightly changed it does not alter the initial character of the pattern.

This improved solution uses two carriage traverses to knit one row of stitches $l1 = 2$; s. Table 1).

Fig. 5 illustrates an incomplete wales rib structure which contains compact

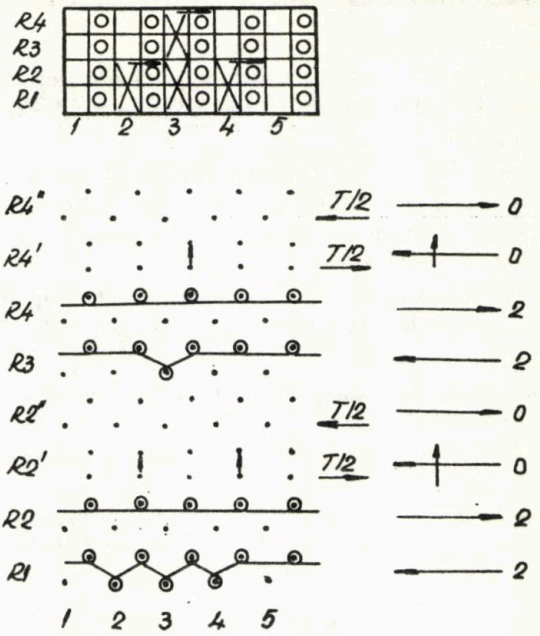

Fig. 5

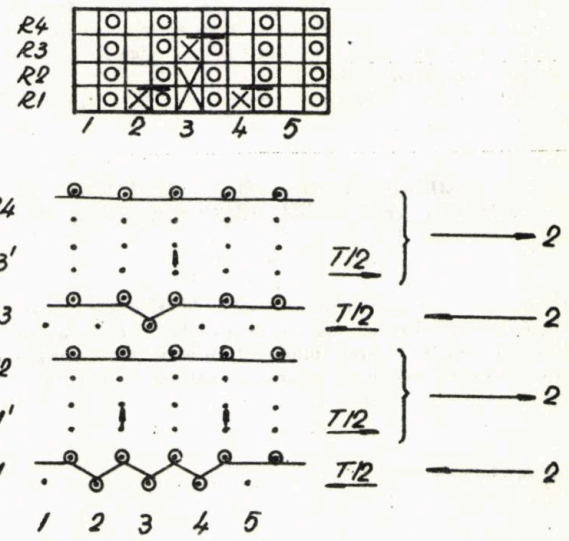

Fig. 6

groups of rib stitches sorrounded by portion of reverse plain knit structure.

The edges of the stitches group are conceived according to the pattern.

The group comprises held and starting loops as well as normal and transfered stitches.

The technological solution illustrated in Fig. 5 uses two carriage traverses to

knit one row of stitches ($Nd1 = 2$; s. Table 1).

Fig. 6 presents a work scheme which permits selection stitch transfer from the front to the back as well as knitting a row of plain stitches on the rear bed on the same movement of the carriage.

Using this solution the stitches which are to be transfered are smaller in size than in the previous case but they don't alter the pattern.

This improved solution uses one carriage traverse for knitting one row of stitches ($Nd1 = 1$; s. Table 1).

3. Conclusions. 1. The optimal solutions should be used in the technological project stage in order that favourable effects may be obtained in the industrial production.

2. The optimised technological solutions may be also adjusted for flat bed machines with several systems.

3. The coefficient K may be used in comparing the work schemes of knitting on flat bed machines.

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OPTIMIZAREA SCHEMELOR DE LUCRU PENTRU REALIZAREA TRICOTURILOR CU OCHIURI TRANSFERATE

(Rezumat)

Lucrarea are ca scop optimizarea schemelor de tricotare pentru realizarea tricoturilor cu ochiuri transferate pe maşini cu un sistem de tricotare. Se urmăreşte creşterea productivităţii operaţiei de tricotare prin reducerea duratei de funcţionare a maşinii de tricotat. Reducerea duratei se face prin eliminarea sau micşorarea numărului de deplasări în gol ale saniei cu lacăte.

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THE ANALYSIS OF FORM AND DISTRIBUTION FOR SOME ANTHROPOMETRICAL DATA USED IN PATTERN CUTTING

BY
STAN MITU, MANUELA AVĂDANEI and MIHAELA MITU

1. Introduction. This paper shows some practical results of the character for the main anthropometrical data used in pattern cutting, for a sample of 150 girls between 16-18 years old.

Using the methods of mathematical statistics for unidimensional repartition, some main dimensional parametres and theirs limits of variation have to be known.

To characterize this age (16-18 years old), 900 measurements have been made, for different anthropometrical data: length and perimeters in order to obtain information about the shape of the human body, such as: height (Ic), bust (Pb), waist (Pt), hips (Ps), front lenght (Lft) and back lenght (Lst).

In this stage, the sample has only 150 girls, but it can be extended for more than that in order to characterize the standard and to establish the probability of meeting a special person in a collectivity.

2. Method of Work. Knowing the values for the main data (as you can see in tables) the purpose of this research is to calculate the tendency of some parameters and some scatters index, as follow:

– the module (Mo) – is the value with the maxim frequency in a range of data;

If the values are divided in classes, the class which has this value is called the modal class.

– the mediate (Me) – is the value which has the property of dividing the range values in equal parts: the number of the bigger values are equal with the less values than it;

– the average ($\overline{x}$) – is the value which can be calculate with the formula:

$$\overline{x} = \frac{\sum_{i=1}^{n} x_i \cdot n_i}{\sum_{i=1}^{n} n_i},$$

where n_i means the level of a private sample, x_i – the private value.

For the analysis, we have to determine the indicators of variation:

– limits of variation,

$$A = x_{\max} - x_{\min}, \quad \text{(cm)};$$

– the average of deviation,

$$d = \frac{\sum_{i=1}^{n} n_i \cdot |x_i - \overline{x}|}{\sum_{i=1}^{n} n_i};$$

– the dispersion (S_x^2) and the square average of deviation (S_x),

$$S_x^2 = \frac{\sum_{i=1}^{n} n_i \cdot (x_i - \overline{x})}{n-1}; \quad S_x = \sqrt{S_x^2}.$$

N o t e: because the sample has more than 25 girls, we have to divide it in classes, as follow:

$$L = 1 + 3.22 \lg n,$$

where: n – the number of subjects; lg – the decimal logarithm.

– the coefficient of variation,

$$V_x = \frac{S_x}{\overline{x}} \cdot 100 \quad (\%).$$

It's better to have 15-18 classes, but for this sample we calculate only 8, for each anthropometrical date: Ic, Pb, Pt, Ps, Lft, Lst.

Having the results, we can plot the polygon of the absolute and relative frequency and the histogramm of absolute and relative cumulated frequency (Figs. 1 *a*, 1 *b*, 2 *a*, 2 *b*, 3 *a*, 3 *b*, 4 *a*, 4 *b*, 5 *a*, 5 *b*, 6 *a*, 6 *b*).

Analysing these results and knowing what has been done in the field of body measurements (anthropometric standard), we can say that some body measurements respect a normal G a u s s - L a p l a c e distribution. These results of all calculations are shown in Table 1.

Table 1

No.	Body measurements	$\overline{x}$ cm	d cm	S_x^2 cm^2	S_x cm	V_x %	b_1 –	b_2 –	E –
1.	Ic	161.98	3.98	25.31	5.03	3.10	0.097	2.17	-0.83
2.	Lst	40.70	1.88	5.30	2.30	5.60	0.340	2.25	-0.70
3.	Lft	50.49	1.78	4.69	2.16	4.30	0.007	2.35	-0.65
4.	Pb	88.40	3.37	16.20	4.02	4.50	0.060	2.13	-0.86
5.	Pt	71.69	3.09	14.57	3.80	5.30	0.240	2.37	-0.63
6.	Pf	95.28	3.88	23.53	4.85	5.09	0.008	2.64	-0.35

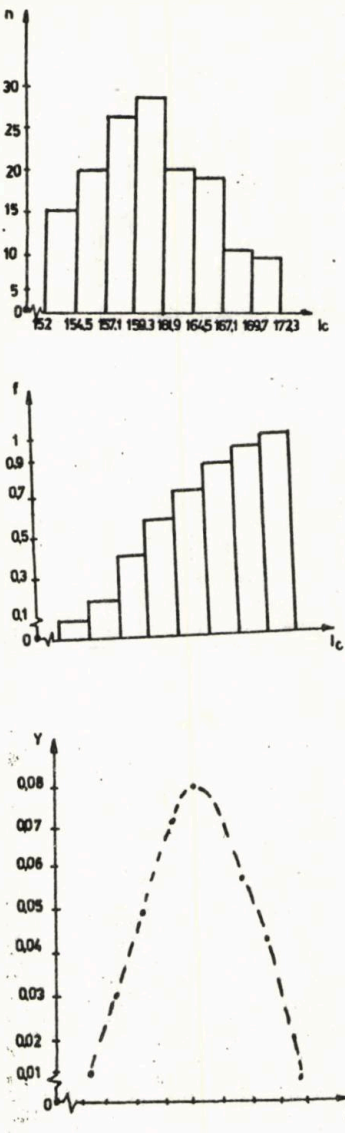

Fig. 1

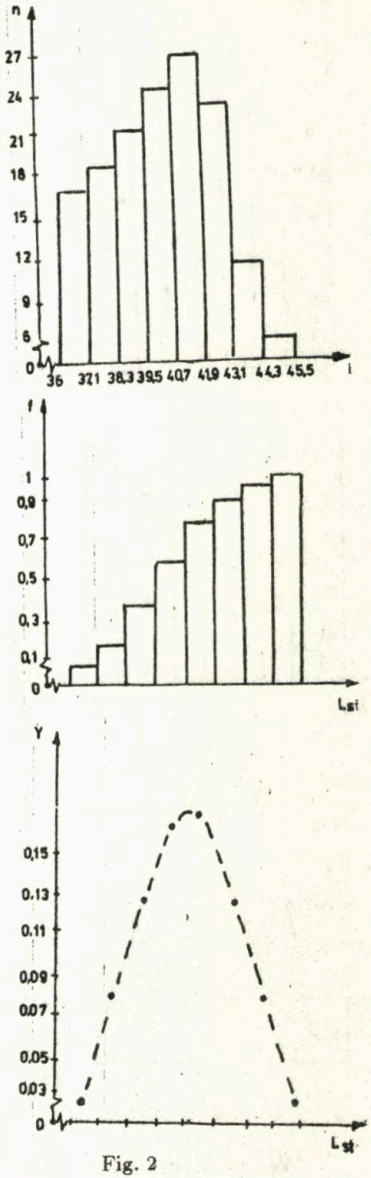

Fig. 2

Analysing these values, it has been noticed that the average of deviation is less than 4 cm, the square of deviation and dispersion are small, the coefficient of variation is less than 10%, all these results lead us to an idea of a normal distribution (which has the private values around the average with the biggest frequency and the property of homogeneous).

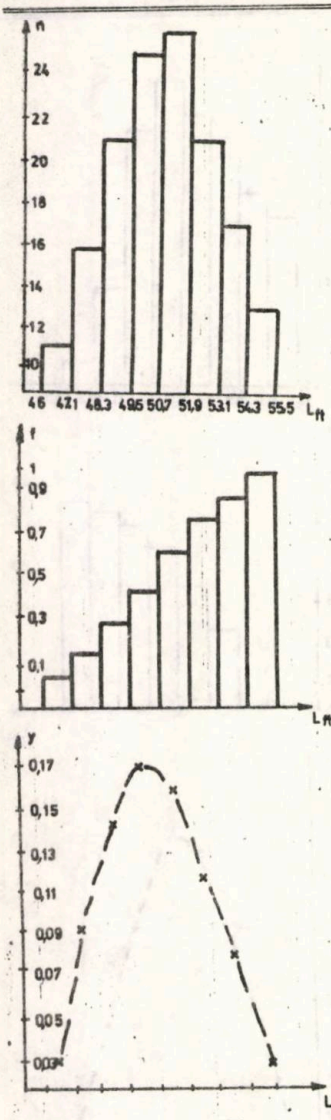

Fig. 3

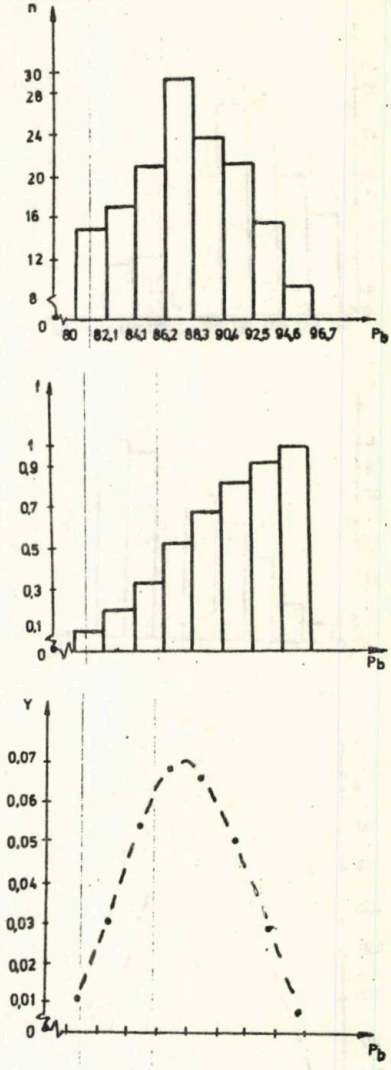

Fig. 4

We can demonstrate the normal distribution of this measurements by calculating some others indicators, such as:

– coefficient of asymmetry,

$$b_1 = \frac{(\mu_3)^2}{(\mu_2)^3},$$

where: μ_2 means the central moment of second order, $\mu_2 = [\sum_{i=1}^{n} n_i \cdot (x_i - \overline{x})]/n$;

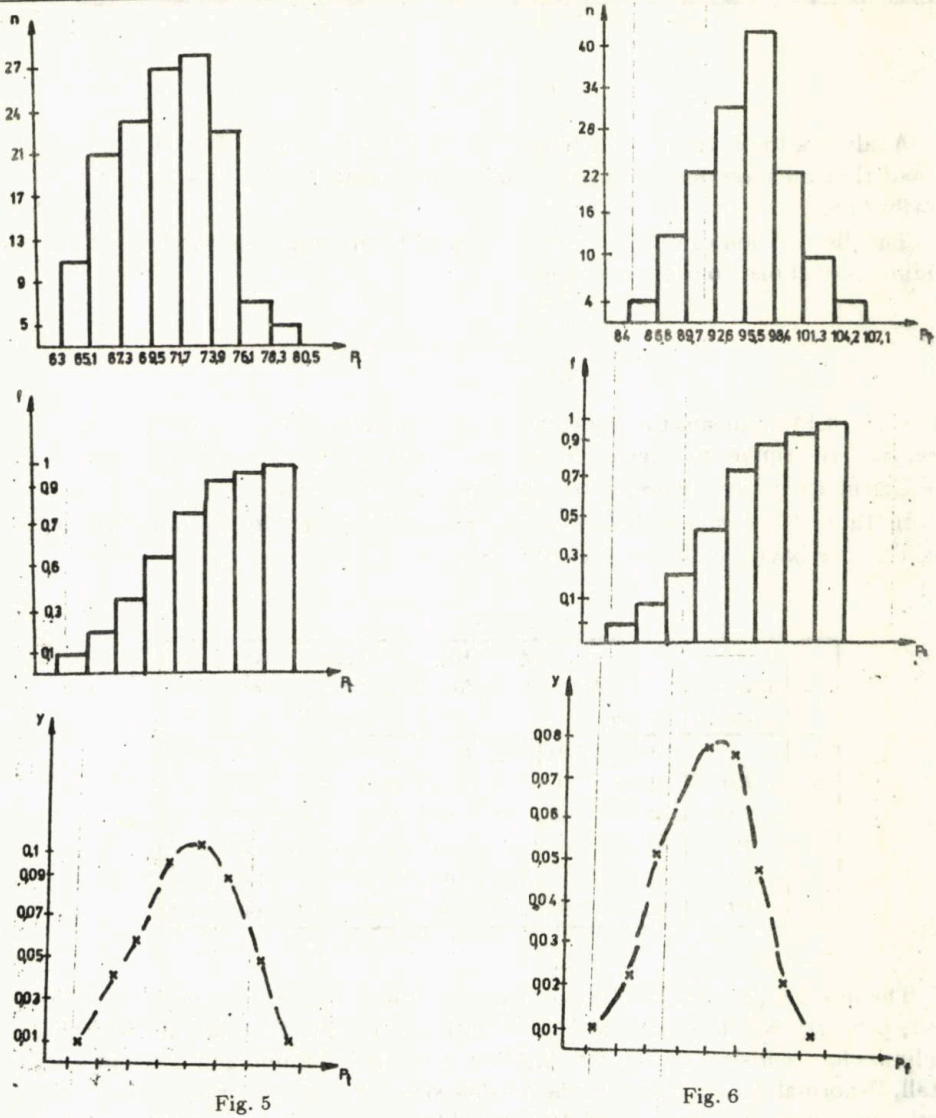

Fig. 5 Fig. 6

μ_3 – the central moment of third order, $\mu_3 = \left[\sum_{i=1}^{n} n_i \cdot (x_i - \overline{x})^3\right] / n$;

– coefficient of arch,

$$b_2 = \frac{\mu_4}{(\mu_2)^2},$$

where μ_4 means the central moment of fourth order, $\mu_4 = \left[\sum_{i=1}^{n} n_i \cdot (x_i - \overline{x})^4\right] / n$

The asymmetry of this distribution can be also check by calculating the excess coefficient, with the formula:

$$E = b_2 - 3.$$

Analysing these group off indicators ($b_1 \cong 0.2 < b_2 < 3$, $E \cong 0$) it is demonstrated that all these measurements respect the normal G a u s s - L a p l a c e distribution.

The distribution can be analytically defined by an expresion, valid only for an unidimensional distribution, as follow:

$$y = \frac{1}{\sqrt{2}\pi S_x} e^{-\frac{1}{2}[(x_i - \overline{x})/S_x]^2},$$

where $\pi = 3.14$; x_i means the class average; $\overline{x}$ – the average of the anthropometrical date; S_x – the square average of deviation; e – the base of natural logarithm.

Calculating these values, we can plot the curves adequate.

In Table 2, the values of absolute and relative frequency for the anthropometrical data we have mentioned already are shown.

Table 2

No.	Body measure-ments	Limits ($\overline{x} \mp S_x$) (cm)	Abs. freq. –	Rel. freq. –	Limits ($\overline{x} \mp 2S_x$) (cm)	Abs. freq. –	Rel. freq. –
1.	*Ic*	156.96-167.01	64	0.42	151.92-172.04	145	0.96
2.	*Lst*	38.40- 43.00	97	0.64	36.10- 45.30	145	0.96
3.	*Lft*	48.30- 52.65	93	0.62	46.17- 54.81	137	0.91
4.	*Pb*	84.38- 92.40	102	0.62	80.36- 96.40	146	0.97
5.	*Pt*	67.89- 75.49	100	0.66	64.09- 79.29	147	0.98
6.	*Pf*	90.4 -100.10	100	0.66	85.57-104.98	142	0.94

The interval $(\overline{x} - 3S_x, \overline{x} + 3S_x)$, includes all the values for each body measurement, property which is valid for a normal L a p l a c e distribution. Knowing the limits for each size, we can establish the frequency of framing in different sizes (I-tall, II-normal, III-short) and some possible size combination for a good framing, for the sample of girls between 16-18 years old (as you can see in Table 3).

Table 3

Body measure ment	The ave-rage (cm)	Height –	Limits (cm)	Abs. freq. –	Rel. freq. –
Height (Ic)	156	III	153-158.9	44	0.29
	162	II	159-164.9	52	0.35
	168	I	165-170.9	44	0.29

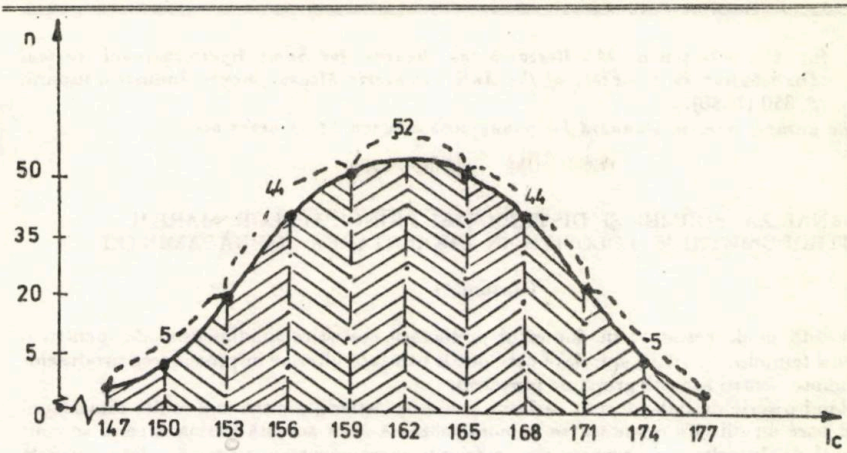

Fig. 7

From the Fig. 7, which shows the curve G a u s s - L a p l a c e, for *Ic*, we notice that there are only 5 values out of the limits we have established; this is a private aspect which means that there are subjects who cannot be included in the anthropometric standards.

3. Conclusions. These results, used in pattern cutting, allow some conclusions, such as:

– for research it's better to extend the volume off data;

– the subjects from a sample must have the same preocupations, live in the same area and must be in the same limit of age, that we have established;

– analysing the Figs. 1*c*, 2*c*, 3*c*, 4*c*, 5*c*, 6*c*, it's important to notice the symmetry of the branches, a wellknown characteristic for a normal G a u s s - L a p l a c e distribution;

– using these method of work, for others samples, we may establish the number of the garments for different sizes;

– analysing the curve G a u s s - L a p l a c e, we can say that in the intervals $(\overline{x} \mp S_x; \overline{x} \mp 2S_x; \overline{x} \mp 3S_x)$, there are equal number of subjects related to the average, so it's possible to combinate different sizes, as follow: I-II, II-III.

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ANALIZA FORMEI ŞI DISTRIBUŢIEI PRINCIPALELOR MĂRIMI ANTROPOMETRICE FOLOSITE ÎN PROIECTAREA ÎMBRĂCĂMINTEI

(Rezumat)

Se prezintă unele rezultate în domeniul prelucrării statistice unidimensionale, pentru o selecţie de sex feminin, de 16-18 ani, date care pot fi utilizate ulterior în proiectarea produselor de îmbrăcăminte pentru această grupă de purtători.

Calculând o serie de indicatori ai variaţiei şi ai împrăştierii, pentru mai multe dimensiuni ale corpului care au diferite orientări, se demonstrează că şi în această perioadă când se continuă procesul de dezvoltare a organismului, mărimile antropometrice respectă o lege normală de distribuţie unidimensională G a u s s - L a p l a c e, demonstrând dezvoltarea armonioasă a corpului.

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Secţia VIII
TEXTILE. PIELĂRIE

A METHOD FOR ESTABLISHING THE SATISFYING DEGREE OF A FEMALE POPULATION WITH LADIES UNDERWARE PRODUCTS, FROM A DIMENSIONAL POINT OF VIEW

BY
MIOARA CREŢU

1. Introduction. We can define the satisfying degree for a population, determined with a system of body-type as the absolute or relative number of persons, whom these products sent them very well (this definition is given from a dimensional point of view).

It's known that dimensional typology suppose first to solve the problems between the main anthropometrical data, which characterize the body-type, and the interval for each main dimension, established between two neighbour bodies.

These both aspects must be approached considering the correspondence between the particularities of the garments for which we have to know the dimensional typology and the main properties of the raw material.

So, for the ladies underwear, which must would and uphold the bust, there have been chosen for pattern cutting the maxim perimeter of the bust (P_bIII) and the perimeter from the base of the bust (P_bIV), as the main data (these both two kind of dimensions can better characterize the developing degree of the bust).

Fig. 1

Corresponding to these two dimensions, the famous firms specialized in the garments producing use a system of body-type, shown in the Table 1.

Knowing the difference between P_bIII and P_bIV (P_bIII-P_bIV), the ladies underwear are made with different values for the bucket dimension, but for the same interval of variation for P_bIV. Concerning that for the making modern ladies underwear, we are using elastic materials, for the system of body-type which we have already presented, it's better to give these two body dimensions as the interval of variations, not as the absolute values.

2. The Essence of This Study and the Main Data which Have to Be Known. Because the ladies underwear garments have to uphold some soft tissue, as the main function, for getting an aesthethic moulded form of the woman body the most interested group for these ladies products are stout women.

Table 1

P_bIV, cm	P_bIII-P_bIV, [cm]					
	Bucket A	Bucket B	Bucket C	Bucket D	Bucket E	Bucket F
63- 67			E	E	E	E
68- 72				E	E	E
73- 77						
83- 87	12-14					
88- 92		14-16				
93- 97			16-18			
98-102				18-20		
103-107					20-22	
108-112	E					22-24
113-117	E					
118-122	E	E				
123-127	E	E			E	E

Note: E – it means that the variant must be excluded from the system of body-type.

So, the first step for this study, was the stage choosing, for about 125 stout women, and after that, there were measured to find out the values for P_bIII and P_bIV (100 cm$\leq P_b$III$\leq$ 134 cm).

In the Table 2 and Fig. 2 it's shown the distribution value for the difference (P_bIII-P_bIV).

Table 2

No. of class	P_bIII-P_bIV cm	ni	No. of class	P_bIII-P_bIV cm	ni
1	$\leq$6.5	3	12	17 – 17.5	13
2	7 – 7.5	3	13	18 – 18.5	9
3	8 – 8.5	3	14	19 – 19.5	7
4	9 – 9.5	3	15	20 – 20.5	6
5	10 – 10.5	3	16	21 – 21.5	5
6	11 – 11.5	2	17	22 – 22.5	6
7	12 – 12.5	8	18	23 – 23.5	3
8	13 – 13.5	13	19	24 – 24.5	2
9	14 – 14.5	7	20	25 – 25.5	–
10	15 – 15.5	14	21	26 – 26.5	–
11	16 – 16.5	12	22	27 – 27.5	2

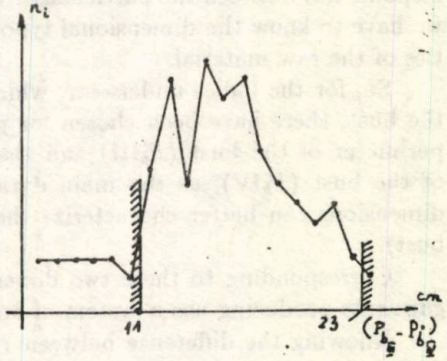

Fig. 2

After we analyse this distribution, we notice that only 19 subjects from the stage have the difference value out of the dimensional typology; those subjects are the persons who cannot be find garments made by the industrial system.

Analysing from the producer and the buyer point of view, it's important to know the manner of distribution for different cases which were met on different

dimensional variants and also the correspondence between the values for the P_bIII and P_bIV when the subjects are out of the dimensional typology.

Table 3

P_bIII-P_bIV (cm.) / P_bIV (cm.)	Bucket A 12-13.9	Bucket B 14-15.9	Bucket C 16-17.9	Bucket D 18-19.9	Bucket DD 20-21.9	Bucket F 22-24
63 – 67.9			E	E	E	E
68 – 72.9				E	E	E
73 – 77.9						
78 – 82.9					1	2
83 – 87.9		1	6	2	2	1
88 – 92.9	5	9	11	10	5	4
93 – 97.9	9	5	5	3		1
98 –102.9	4	4	4	1	3	2
103 –107.9	2					
108–112.9	E	2				1
113–117.9	1					
118–122.9	E	E				
123–127	E	E			E	E

3. Conclusions. Refering these 20 subjects, who are out of the dimensional typology to the whole volume of the stage, we can say that the value for satisfying degree is P_k=84%, for a number of 58 bodies-type.

It can be estimated that the value which was obtained for P_k is acceptable for all these kind of garment which are made in an industrial system (in a big number).

Table 4

No	P_bIV [cm]	P_bIII – P_bIV [cm]	No	P_bIV [cm]	P_bIII – P_bIV [cm]
1	92	6.0	11	108	9.0
2	97	5.0	12	119	7.0
3	95	9.0	13	125.5	7.5
4	82	27.0	14	96	9.0
5	104.5	5.0	15	109	10.0
6	91	10.5	16	92	10.0
7	95.5	11.0	17	92.5	8.0
8	100	7.0	18	98	8.5
9	95	27.0	19	93	8.5
10	98	11.0	20*	98	11.0

Notes: in every cell of this table, it's noticed the number of subjects who are met; we notice the variant must be excluded.

It's necessary to mention that 85% from the subjects, whom are out of the dimensional typology, will consider all the garments, which were made in this system (already presented), with the buckets too big. In this case, it's necessary to give a big attention to those dimensional variants which will offer to these subjects an harmonious conformation and also a good surface (or base) for external garments.

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STUDIU PRIVIND STABILIREA GRADULUI DE SATISFACERE, DIN PUNCT DE VEDERE DIMENSIONAL, A POPULAŢIEI CU PRODUSE DE CORSETĂRIE

(Rezumat)

Luând în consideraţie faptul că produsele de corsetărie au ca principală funcţie susţinerea ţesuturilor moi şi formarea estetică a corpului feminin, cel mai interesat grup de purtătoare îl reprezintă femeile de conformaţii corpolente.

A fost studiat un eşantion format din 125 subiecţi, femei corpolente (P_bIII$\geq$108 cm), calculându-se gradul de satisfacere (P_k=84%) din punct de vedere al identificării cu topologia dimensională specifică, utilizată în prezent pe plan mondial.

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TEXTILE. PIELĂRIE

MATHEMATIC MODELLING BY LAGRANGE INTERPOLATION OF FOOTWEAR COMPONENTS CONTOURS AND THEIR GRAPHIC VISUALIZATION

BY

DAN-FLORIN CROITORU, RODICA VOLOCARIU and MARIANA COCEA

1. Introduction. Computer assisted design (CAD) is a complex process which assumes a very accurate assessment of the model to be designed wich results in implacable programs. In footwear industry CAD requires a know edge of the geometric model to be designed. Mathematic modelling relies on the equation of the model contour function, which would allow a processing of the contours (grading, alterering of model shape, optimizing consumption of materials, economic estimates, a.s.o.

2. Mathematic Modelling of Components. Contours. Requirements. Shapes, contours cannot be identified, in designing, by simple functions of the form $y = f(x)$, because most of them have irregular forms, with many concavities and convexities, which explains why their form is intrinsically dependent on the coordinates system. For example, if we want to plot a curve, it is absolutely necessary that we choose the right set of contour points in a system of coordinates, but the important factor in determining the form of the object is the relation between these points, not that between the points and the randomly chosen coordinates system.

Furthermore, the contour forms may have vertical tangents. If the shape were represented by a function $y = f(x)$, the vertical tangents would be an inconvenient in designing, which might be avoided by an approximation of analytic function (e.g. of polynomials). For all these reasons, the dominant representation of shapes in CAD is not possible with a function $y = f(x)$ but a set of functions which can be obtained on various partions.

The analytic functions, approximating the contour to be designed, may be obtained by extrapolation if and only if there has been made a numeric coding of the geometric body, which should furnish all necessary data.

As, however, many contours have irregular forms, the mathematic models are approximative. Taking into account the advance of computation technique for these last years, we can assess that highly performant programmes lead to approximations

with minimum of errors.

Mention has to be of the processing centers with numerical command existent in highly developed countries, where, on the basis the coordinates of a set of points, the model to be designed is physically made up with the desired accuracy.

On a local scale, although the description and modelling of bodies, which is an initial stage of data input, is slow (from keyboard) or very expensive (with specialized equipment) all efforts will be warranted by the spectacular results obtained.

Therefore, being given a finite number of points describing a curve, an interpolation problem is to be solved.

3. Interpolation Methods in Mathematic Modelling. Interpolation is a special case of a more general, approximating problem [3].

A function $f(t)$ will be approximated by interpolation as a finite sum,

$$g(t) = \sum_{i=1}^{n} c_i \times \psi_i(t),$$

of a simple function $\psi_i(t)$, so as to satisfy a certain set of constraints for function $g(t)$. As the constants $c_1, c_2, ..., c_n$ have to be determined, it is necessary that the restrictive conditions for function $g(t)$ should be specified.

Usually these conditions are imposed on the function $g(t)$ so as to be a *good* approximation for function $f(t)$.

If function $g(t)$ is continuous over the approximating interval $[a, b]$ then the function $\psi_1(t)$, $\psi_2(t)...\psi_n(t)$, continuous on $[a, b]$, will be chosen. In the approximating theory, the constraints imposed on function $g(t)$ will very often be the following:

– interpolation constraints:

$$g(t_i) = f(t_i) \quad \forall i \in [1, n],$$

in other words, the functions curves will have the same number of values within a finite number of points;

– mixture of interpolation and constraints:

a) $g(t_i) = f(t_i) \qquad i \in [1, k],\ k < n,$

b) $g'(t_1) = f'(t_1)$ and $g'(t_k) = f'(t_k)$,

c) $g(t)$ – twice differential function;

– variational constraints:

$$||f - g|| = \min\{||f - h||/h \in \text{distance}(\psi_1, \psi_2, ..., \psi_n)\},$$

i.e. constants $c_1, c_2, ..., c_n$ should be chosen in such a way as to allow that the minimum of all possible functions $||f - h||$ should be obtained of the set of all possible linear combinations:

$$h = c_1\psi_1 + c_2\psi_2 + c_3\psi_3 + \cdots + c_n\psi_n.$$

In order to accurately model it is necessary to pay special attention to certain qualities which are characteristic to a set of curves under specific conditions.

Some call this quality a *shape characteristic.*

As shapes cannot be precisely described by a simple function $y = f(x)$ in CAD the shapes are parametrically represented as a set of functions:

$$x = x(t); \qquad y = y(t)$$

Therefore we can say that a point on such a curve is defined by a vector:

$$\overline{P}_c = [x(t), y(t)].$$

This parametric representation is the most adequate description of the way in which curves are traced by a plotter or on a display.

By means of parametric representation of curves, the interpolation problem is reduced to that of determining by interpolation of vector $\overline{P}_c$ representing components.

A whole series of interpolating methods are dealt with in the literature, among which we can mention [1]:

- linear interpolation;
- quadratic interpolation;
- L a g r a n g e interpolation;
- H e r m i t e interpolation;
- S p l i n e interpolation;
- C e b i c e v interpolation.

In this paper we have made up a programme in order to obtain forms by L a g r a n g e interpolation, reason for which we will give the theoretic presentation of this method, the description of the programme, the way of working with it and the obtained results.

4. Lagrange Interpolation. The L a g r a n g e interpolation is a classic method of interpolation. The L a g r a n g e polynomials are among the simplest interpolating polynomials [2].

Being given $n + 1$ discrete points:

$$x_0 < x_1 < x_2 < \cdots < x_n$$

and a second set of real numbers:

$$y_1, y_2, \ldots, y_n$$

there may be defined the L a g r a n g e polynomial of the nth power, associated to the two sets of number $\{xi, yi\}$ as being the polynomial $P(x)$ which solves the interpolation problem:

$$P(x_i) = y_i, \qquad i \in (0, n),$$

where x_i are called *nodes* and the y_i *constraints of interpolation function.*

The advantage of this way of interpolating is that these polynomials are Single. If a function is defined in $x_0, x_1, x_2, \ldots, x_n$ and the corresponding $y_0, y_1, y_2, \ldots, y_n$ values are known, then:

$$f(x_i) = y_i, \qquad i \in [0, n],$$

and by the L a g r a n g e interpolation of the nth power of the function $f(x)$ in nodes x_1 there results the polynomial:

$$P_n(x) = \sum_{i=1}^{n} f(x_i) \cdot L_i, n(x)$$

with

$$L_{i,n} = \frac{(x - x_0)(x - x_1) \cdots (x - x_{i-1})(x - x_{i+1}) \cdots (x - x_n)}{(x_i - x_0)(x_i - x_1) \cdots (x_i - x_{i-1})(x_i - x_{i+1}) \cdots (x_i - x_n)}$$

or expressing the classic polynomial, the L a g r a n g e polynomial becomes a polynomial of the nth power having the form:

$$P_n(x) = a_0 + a_1 \cdot x + a_2 \cdot x^2 + a_3 \cdot x^3 + \cdots + a_{n-1} \cdot x^{n-1}.$$

It results from the theoretical considerations mentioned above that mathematic modelling by L a g r a n g e method implies solving a system of $n + 1$ equations with $n + 1$ unknowns of the form:

$$\begin{cases} y_0 = a_0 + a_1 \cdot x_0 + a_2 \cdot x_0^2 + a_3 \cdot x_0^3 + \cdots + a_n \cdot x_0^n \\ y_1 = a_0 + a_1 \cdot x_1 + a_2 \cdot x_1^2 + a_3 \cdot x_1^3 + \cdots + a_n \cdot x_1^n \\ \vdots \\ y_n = a_0 + a_1 \cdot x_n + a_2 \cdot x_n^2 + a_3 \cdot x_n^3 + \cdots + a_n \cdot x_n^n \end{cases},$$

which may be rewritten in a matrix form as:

$$\begin{bmatrix} y_0 \\ y_1 \\ y_2 \\ \vdots \\ y_n \end{bmatrix} = \begin{bmatrix} 1 & x_0 & x_0^2 & \cdots & x_o^n \\ 1 & x_1 & x_1^2 & \cdots & x_1^n \\ 1 & x_2 & x_2^2 & \cdots & x_2^n \\ \vdots & & & & \\ 1 & x_n & x_n^2 & \cdots & x_n^n \end{bmatrix} \begin{bmatrix} a_0 \\ a_1 \\ a_2 \\ \vdots \\ a_n \end{bmatrix},$$

where (x_i, y_i) with $i \in [0, n]$ are the points describing the forme to be identified, or:

$$[Y] = [X] \cdot [A].$$

Therefore, the problem consists in determining the polynomial coefficients $a_0, a_1, a_2, ..., a_n$, and the vector $[A]$, respectively, by solving a system of $n + 1$ equations with $n + 1$ unknowns.

5. Programme for Mathematical Modelling of a Contour by Lagrange Interpolation. As an example there has been considered the contour of a component, i.e. the inner sole, to which a system of XOY coordinates was attached; the contour of the component was divided in several partions of convenient size, as

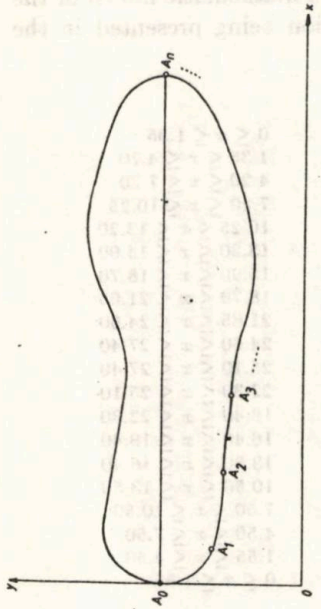

Fig. 1

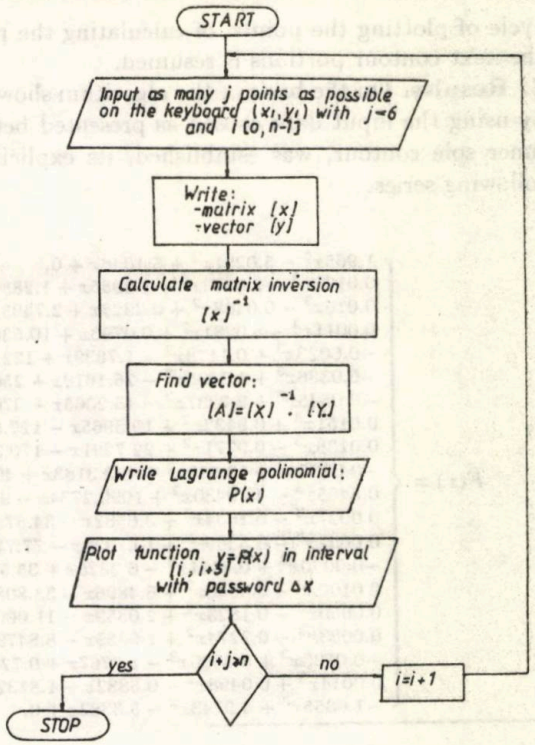

Fig. 2

shown in Fig. 1, after which the coordinates (x_i, y_i) of the chosen points, necessary for L a g r a n g e interpolation, were selected.

Plotting the contour and finding the corresponding polynomial functions could be done on small segments of the contour, starting from the origin up on the abcissa, in order to get the modelled contour, as close to the real one as possible.

The programme for the mathematic modelling, by L a g r a n g e interpolation, of a contour whose points have known coordinates is an interactive one. It was written in C language and was elaborated using the algorithm shown in Fig. 2. Mention is made to the fact that an accurate modelling of a number of points the nth power of the polynomial does not have to be too big, because, in programme running there occur errors of the type *overflow floating points* and oscillations in displaying the polynomial.

When implementing the programme, by pushing C key, the computer will ask the number of points by which it is desired to plot the contour and their coordinates. Then, by activating ENTER the computer will mark the points on the screen, will give the corresponding polynomial function and will plot the continuous contour of the component, over a certain portion of it.

In order to obtain the whole contour, the key C is activated again, and the

cycle of plotting the points, of calculating the polynomial function and of getting the next contour portions is resumed.

6. Results. On the basis of the algorithm shown in Fig. 2 and of the programme, by using the input data chosen as presented before, the mathematic model of the inner sole contour, was established, its explicit function being presented in the following series:

$$F(x) = \begin{cases} 1.965x^3 - 5.0291x^2 + 5.1346x + 0, & 0 \leq x \leq 1.35 \\ 0.0176x^3 - 2.0845x^2 + 1.2955x + 1.2886, & 1.35 \leq x \leq 4.20 \\ 0.016x^3 - 0.0468x^2 + 0.2323x + 2.7495, & 4.20 \leq x \leq 7.20 \\ 0.0011x^3 - 0.0281x^2 + 0.0793x + 10.5382, & 7.20 \leq x \leq 10.25 \\ -0.0023x^3 + 0.1178x^2 - 1.7839x + 122.8388, & 10.25 \leq x \leq 13.20 \\ -0.0386x^3 + 1.7235x^2 - 25.1619x + 250.5496, & 13.20 \leq x \leq 15.90 \\ -0.0545x^3 + 2.7337x^2 - 45.2365x + 370.0594, & 15.90 \leq x \leq 18.70 \\ 0.0151x^3 + 0.9432x^2 + 19.3965x - 127.5142, & 18.70 \leq x \leq 21.65 \\ 0.0138x^3 - 0.9771x^2 + 22.7291x - 170.3883, & 21.65 \leq x \leq 24.60 \\ -0.0235x^3 + 18.588x^2 + 473.3183x + 4022.1819, & 24.60 \leq x \leq 27.40 \\ 0.5405x^3 - 42.0430x^2 + 1090.2734x - 9428.424, & 25.10 \leq x \leq 27.40 \\ 0.0027x^3 - 0.1634x^2 + 3.6982x - 34.5799, & 22.30 \leq x \leq 25.10 \\ 0.0092x^3 - 0.5369x^2 + 10.7324x - 77.7159, & 19.40 \leq x \leq 22.30 \\ -0.0050x^3 + 0.3111x^2 - 6.2325x + 35.5711, & 16.40 \leq x \leq 19.40 \\ 0.0107x^3 - 0.4640x^2 + 6.4896x - 33.8080, & 13.50 \leq x \leq 16.40 \\ 0.0050x^3 - 0.1823x^2 + 2.0359x - 11.0001, & 10.50 \leq x \leq 13.50 \\ 0.0083x^3 - 0.2274x^2 + 1.9369x - 8.8479, & 7.50 \leq x \leq 10.50 \\ -0.0133x^3 + 0.2600x^2 - 1.7767x + 0.7254, & 4.50 \leq x \leq 7.50 \\ 0.0014x^3 + 0.0498x^2 - 0.5882x - 1.8132, & 1.55 \leq x \leq 4.50 \\ -1.6855x^3 + 4.9743x^2 - 5.3382x + 0, & 0 \leq x \leq 1.55 \end{cases}$$

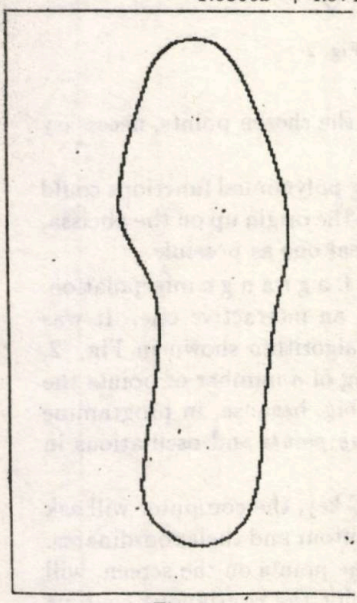

Fig. 3

The programme made possible a graphical visualization of the mathematic functions obtained as shown in Fig. 3.

7. Conclusions. Writing the function of a contour by L a g r a n g e interpolation and its visualizing is one of the simplest and most efficient ways of analytically identifying a form wich will allow the CAD of the component.

The programme whose algorithm has been previously shown is made on an IBM-PC 286 computer, being possible to reimplement it on any type of computer, the performance of the programme, accuracy in identifying the form, running speed, being closely connected to the computation power of the apparatus.

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MODELARE MATEMATICĂ PRIN INTERPOLARE LAGRANGE A CONTURURILOR REPERELOR ÎNCĂLŢĂMINTEI ŞI VIZUALIZAREA LOR GRAFICĂ

(Rezumat)

Se prezintă elaborarea unei metodologii (bazate pe metoda de interpolare Lagrange) pentru obţinerea modelului matematic al oricărui contur neregulat şi vizualizarea sa cu cât mai multă acurateţe pe monitor sau la imprimantă.

BULETINUL INSTITUTULUI POLITEHNIC DIN IAŞI
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Secţia VIII
TEXTILE. PIELĂRIE

ÉTUDE CONCERNANT LES PARTICULARITÉS DIMENSIONELLES DU PIEDS MOYEN REPRÉSENTATIF POUR DIFÉRENTES CATÉGORIES DE LA POPULATION SPORTIVE

PAR

GABRIELA MĂLUREANU et FLORENTINA HARNAGEA

Pour satisfaire les demandes des sportifs avec de chaussure de qualité n'est pas suffisant à assurer sa diversification constructive, mais il est nécessaire à élaborer une chaussure d'une construction adéquate aux particularités dimensionelles des pieds des sportifs en étroite dépendance des sollicitations imposées à la pratique d'une certaine discipline sportive [3].

L'élaboration des normatives concernant la construction des embauchoirs et de la chaussure, destinée aux porteurs qui pratiquent de différentes catégories de sports de performance dans les clubs de Roumanie, doit avoir à la base des informations sur les caractéristiques de l'anthropométrie qui définissent le pied moyen représentatif d'une certaine catégorie de populations sportives.

Il est important aussi à établir le type de pied caractéristique pour la population qui pratique une certaine discipline sportive, les dépendences existentes entre les mesure caractéristiques des différents segments du pied, les proportions déterminées par les liaisons de corrélation [2], [3].

Au même but, il est nécessaire à connaître le spécifique de la biomécanique du pied à la pratique d'un certain sport, à déterminer les intervalles de temps où les sportifs exploitent activement la chaussure, à connaître les pressions admissibles sur le pied du point de vue de la chaussure aussi comme la modification des paramètres anthropométriques au passage de la statique à la dynamique particulière d'un certain type de sport [1], [3].

Dans le cadre de l'étude ci présente, on a suivi la mise en évidance des particularités anatomo-morphologiques des pieds des sportifs de Roumanie qui pratiquent de différents disciplines sportives (handball, tennis, football), les modifications qui apparaissent aux pieds des populations sportives envers la population habituelle, par suite à l'adaptation du pied aux sollicitation propres d'un certain type de sport.

Tenant compte de l'objectif mis en attention, on a formé des sélections représentatives, contenant des sujets du même group d'âge (18 – 35 années), du même sexe (masculin) différenciés par disciplines sportives, les sélections étant prélevées du cadre des populations sportives qui pratiquent les sports de performance aux di-

fférents clubs du pays. De chaque sujet de la selection on a prélevé des paramètres anthropométriques caractéristiques, les uns mesurés sur la carte anthropométrique (des longueurs et des largeurs particulièrs), les autres directement sur pied (des périmètres et des hauteurs).

Sur la base de la carte anthropométrique, la carte qui contient le contour de gabarit du pied et l'empreinte plantaire, on a pu faire une appréciation objective de la forme et des dimensions de la surface d'appui du pied, de l'état des voûtes longitudinales et transversales, des zones où se manifeste des modifications d'adaptation aux pieds des sportifs.

Dans le Tableau 1, on montre les paramètres statistiques d'estimation des plus importants paramètres anthropométriques, pour les populations sportives et pour la population habituelle appartenant au même intervalle d'âge (dix-huit à trente-cinq ans) et du même sexe (masculin).

Tableau 1

Paramètres antropo-métriques	La population sportive									La population habituelle		
	Handball			Tennis			Football					
	$\overline{X}$	Sv	Cv	$\overline{X}$	Sv	Cv	$\overline{X}$	Sv	Cv	$\overline{X}$	Sv	Cv
L_p	287,67	12,85	4,46	275,45	8,86	3,21	271,29	11,66	4,29	266,57	11,67	4,42
L_I	202,33	12,73	6,29	200,39	8,85	4,41	191,81	9,45	4,85	194,84	9,49	4,87
L_V	180,39	12,24	6,79	168,42	10,80	6,42	165,23	8,59	5,19	164,02	8,88	5,41
L_b	137,12	7,62	5,55	131,83	9.97	7,56	130,07	7,63	5,86	128,32	8,41	6,55
L_c	40,10	3,64	9,07	40,85	7,06	17.29	38,93	3,52	9,01	42,24	5,72	13,34
l_d	114,18	6,07	5,31	108,89	5,65	9,19	110,15	5,59	5,08	106,39	5,86	5,52
l_c	72,70	4,26	5,86	69,35	4,45	6,41	67,69	4,39	6,49	69,41	4,71	6,79
l_b	92,16	5,49	7,04	86,23	8,03	9,31	89,62	6,38	7,12	85,58	7,03	8,22
P_d	268,39	15,09	5,62	264,34	18,45	6,98	261,92	11,81	4,51	259,31	12,64	4,87
P_r	268,08	12,56	4,68	259,69	13,45	5,18	258,38	10,83	4,17	258,08	14,14	5,48
P_c	356,42	16,87	4,73	342,25	22,61	6,60	334,39	18,29	5,37	337,94	18,99	5,61

Comme observation générale on apprécie que les valeurs moyennes des paramètres anthropométriques qui caractérisent le pied des trois populations sportives, sont dans tous les cas, plus grands que ceux qui correspondent à la population habituelle. Des différences significatives apparaissent d'une discipline sportive à l'autre.

Dans le Tableau 2 on présente les évolutions des principaux paramètres anthropométriques (L_p, P_d, l_d) du pied aux populations sportives envers la population habituelle.

Tableau 2

Handballeurs			Tennismens			Footballeurs		
ΔL_p	Δl_d	ΔP_d	ΔL_p	Δl_d	ΔP_d	ΔL_p	Δl_d	ΔP_d
21,09	7,79	9,08	8,87	2,49	5,03	4,71	3,76	2,61

La face de L_p du pied à la population habituelle, les handballeurs présentent une croissance ΔL_p de $\cong$ 21 mm, les tennismens de $\cong$ 9 mm, et les footballeurs de $\cong$ 5 mm.

Ces différences peuvent être expliqués comme le principal résultat de la sélection en groupes préparatoires des sujets à certaines caractéristiques somato-anthropométriques nécesaires à la pratique d'un certain type de sport.

1° On a employé les notations suivantes: L_p – la longueur du pied; L_I, L_V, L_b, L_c représentent les distances mesurées du point extrême postérieur du pied à: – le centre de l'articulation métatarso-phalangienne I, L_I, – le centre de l'articulation métatarso-phalangienne V, L_V, – le milieu de la voûte longitudinale, L_b, – le centre du talon, L_c; l_d – la largeur aux doigts, l_b – la largeur dans la zone la plus baute de la voûte, l_c – la largeur au centre du talon, P_d – le périmètre aux doigts, P_r – le périmètre du coup-de-pied, P_c – le périmètre sur le talon.

2° Les unités de mesure dans lesquelles on exprime les valeurs moyennes aritmétiques ($\overline{X}$) et les erreurs moyennes carrées (Sx) sont exprimées en milimètres; le coefficient de variation (Cv) est exprimé en pourcentages.

Les évolutions des paramètres transversales propres à la zone antérieure du pied des sportifs envers la population habituelle se justifient en principal par la biomécanique du pied, propre à chaque discipline sportive et caractérisée par une grande charge dynamique dans la zone des articulations métatarso-phalangiennes.

Entre les paramètres anthropométriques du pied, ont été définies une série de familles de corrélations [1], [2] avec des implications directes dans l'activité de projection, les formes simplifiées de ces corrélations caractérisant les coefficients de proportionalité entre les variantes impliquées en dépendance.

L'analyse des coefficients de proportionnalité (Ki) – Tableau 3 –, d'entre les caractéristiques dimensionnelles de base de pied, permettent les différences de la typologie des pieds aux sujets qui pratiquent un certain type de sport.

Ainsi, après la caractéristique générale de la forme du pied exprimée par le rapport $K_l = l_d/L_p$, on apprécie que des trois populations sportives, les footballeurs ont le pied relativement plus large que les tennismens et les handballeurs.

Tableau 3

Le coefficient de proportionalité	Handballeurs	Tennismens	Footballeurs	Population habituelle
$K_1 = L_d/L_p$	0,396	0,395	0,406	0,399
$K_2 = L_I/L_p$	0,703	0,727	0,707	0,730
$K_3 = L_V/L_p$	0,627	0,611	0,609	0,611
$K_4 = L_c/L_p$	0,140	0,148	0,143	0,148
$K_5 = l_c/L_p$	0,252	0,251	0,250	0,260
$K_6 = P_d/L_p$	0,932	0,959	0,965	0,972
$K_7 = P_r/L_p$	0,934	0,942	0,952	0,968
$K_8 = l_d/P_d$	0,405	0,411	0,420	0,412
$K_9 = l_d/l_c$	1,360	1,380	1,430	1,360

Relativement large est aussi le pied de la population habituelle.

Le type du pied après les caractéristiques des longueurs partielles est caractérisé par le coefficient $K_2 = L_I/L_p$.

On apprécie que le coefficient K_4 est assez stable à ces trois catégories de populations sportives et proche comme valeur de celui rencontré à la population habituelle. Les valeurs des coefficients K_2 et K_3 varient dans les limites 0,60 ... 0,63, des variations qui doivent être en attention, dans la construction des embauchoirs et des repères composants de la chaussure. À la suite de la modification de la position de la ligne de pliages répétés en dynamique.

Les petites valeurs du coefficient K_2 chez les footballeurs et les handballeurs sont le résultat d'un petit exhaussement de la voûte du pied par suite à la course de vitesse pendant la pratique du sport, c'est-à-dire une modification d'adaptation du pied à des sollicitations intervenues à la pratique du sport.

Le type du pied déterminé par la largeur du talon est caractérisé par le rapport $K_5 = l_c/L_p$.

Après cette caractéristique on observe que le pied des sportifs est en général plus étroit dans cette zone que de la population habituelle, explicable par le transfert de l'effort sur l'antépied en dynamique.

La plénitude relative du pied peut être caractérisée par les coefficients $K_6 = P_d/L_p$ et $K_7 = P_l/L_p$. Leurs valeurs montrent que le type de pied relativement plus plein se rencontre chez les footbaleurs, et plus étroit chez les handballeurs. Il faut mentioner que dans les limites du pied relativement plein caractéristique pour les footballeurs et pour la population habituelle on voit l'existence des differences sur le rapport $K_p = l_d/P_d$. C'est-à-dire une évolution de la surface d'appui du pied chez les footballeurs envers la population habituelle, chose confirmée aussi par la valeur du rapport $K_p = l_d/l_c$.

Pour la determination de la loi de construction de la série de mesures et des largeurs des embauchoirs pour la chaussure sportive, l'analyse de la liaison de corrélation entre les paramètres de base du pied et les évolutions résultées de ces corrélations par le passage d'une mesure à l'autre, dans le cadre de la série (Tableau 4), présent l'intérêt.

Tableau 4

La corrélation	L'évolution	Handballeurs	Tennismens	Footballeurs	Population habituelle
$P_d = f(L_p)$	P_d/Nm	2,44	2,37	2,86	2,90
$P_r = f(L_p, P_d)$	P_r/Nm	2,57	2,72	2,64	2,59
$l_d = f(L_p, P_d)$	l_d/Nm	1,01	1,04	1,17	1,15
$l_c = f(L_p, P_d)$	l_c/Nm	0,60	0,65	0,55	0,67

Les évolutions du Tableau 4 montrent que les liaisons entre les paramètres anthropométriques chez les sportifs et la population habituelle sont analoges, et par suite, les modifications des paramètres à l'opération de gradation peuvent être

adoptées aux mêmes valeurs pour les embauchoirs utilisés à confection de la chaussure habituelle aussi comme celle pour les sportifs.

La construction de l'embauchoir doit tenir compte des particularités anatomo-morphologiques de chaque catégorie de sportifs ayant en vue les différences significatifs des valeurs moyennes. Ainsi, les dates du Tableau 1 justifient la necessité de la réalisation des sortiments de mesures et largeurs différentiées sur chaque discipline sportive et implicitement à la typodimension d'embauchoirs propres à chaque discipline sportive concernant l'assurence du confort dimensionnel pour la chaussure à ce groupe de porteurs.

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Université Technique „Gh.Asachi", Jassy,
Chaire de Tricotages et Confections

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STUDIU PRIVIND PARTICULARITĂŢILE DIMENSIONALE ALE PICIORULUI MEDIU REPREZENTATIV PENTRU DIFERITE CATEGORII DE POPULAŢII SPORTIVE

(Rezumat)

Sunt prezentate particularităţile dimensionale ale piciorului mediu reprezentativ la populaţiile sportive ce practică sportul de performanţă în România, populaţii diferenţiate pe categorii de discipline sportive (tenis, fotbal, handbal).

Se analizează diferenţierile ce apar ca urmare a modificărilor de adaptare impuse de biomecanica particulară sportului respectiv.

Se reliefează tipul reprezentativ de picior prin analiza comparativă a unor coeficienţi rezultaţi din modelele de corelaţie stabilite între principalii parametri antropometrici.

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TEXTILE. PIELĂRIE

CONSIDÉRATIONS CONCERNANT LA PROJECTION DES MATRICES NONCONVENTIONNELLES OÙ ON OBTIENT DES SEMELLES POUR CHAUSSURES

PAR
CORNELIA IONESCU

1. Introduction. Dans le secteur des prêts-à-porter de cuir et remplacants, la productions de chaussures représente l'activite avec la plus grande importance.

La diversification des modèles de chaussures se réalise en agissant sur l'ensemble supérieur et sur l'ensemble inférieur.

Si on se rapportait aux possibilités de diversification des modèles de semelles on est connu le fait que celles-ci peuvent être obtenues monolithe ou détachées du talon, par matriçage de cuir, plaques de caoutchouc, ou par la formation dans la cavité de quelques matrices des matériaux thermoplastiques, thermorigides ou des caoutchoucs polyurétaniques.

Dans les technologies classiques pour obtenir les semelles pour chaussure, à l'aide des matrices, on est connu qu'il est nécessaire de projeter et de réaliser une matrice pour chaque modèle et nombre de mesure [1].

On pose la question: on ne pourrait pas realiser des matrices dont la cavité puisse être diversifiée d'une telle manière qu'elle permette la realisation des beaucoup de modèles de semelles sans être nécessaire de se réaliser totalement une nouvelle matrice?

Ce problème a été étudié par le collectif de prête-à-porter de cuir de l'Université Technique „Gh. Asachi" de Iassy et a été bréveté.

2. Solutions proposées. Conformément aux études effectuées [2], [3] dans la même matrice on peut réaliser les modifications suivantes de la cavité: des modifications dans la zone du talon et de la voûte du pied, des modifications dans la zone de la semelle, des modifications du relief antidérapant.

La modification de la forme et des dimensions de la cavité est possible en deux variantes:

A. par l'utilisation des matrices-mère;

B. par l'utilisation des matrices existentes qui présentent un modèle de cavité.

A. **Des modifications de la cavité dans une matrice-mère.** La matrice-mère dans l'acception de ce travail est definie comme une matrice dont la cavité peut circonscire tout volume de semelle, comme dans la Fig. 1.

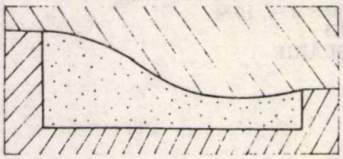

Fig. 1

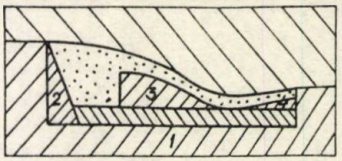

Fig. 2

Dans une matrice-mère, la réalisation d'une cavité d'une certaine forme est possible par l'introduction dans la cavité-mère des pièces, dimensionées, d'une telle manière que par l'obturation d'un volume de cette cavité on obtient un modele de semelle, comme dans la Fig. 2.

On a aussi en vue que ces pièces, soient projetées de sorte que par leur montage dans la cavité-mère, conduisent aux semelles de calités esthetiques et de forme similaires avec lesquelles ont été obtenues dans les matrices classiques, à cavité unique.

a. *Des modifications possibles dans la zone du talon et de la voûte du pied.* Dans les conditions où on on part de la cavité-mère, le talon peut être parfaitement orthopedique à valeurs des ongles α et β de 90° et γ de 180°, d'après comme on peut avoir toute autre forme comme dans la Fig. 3.

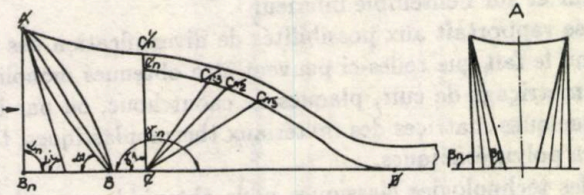

Fig. 3

Dès le début on s'impose une série de restrictions comme: la stabilisation de la position de l'articulation des doigts; la stabilisation de la surface minime de contacte du talon avec le plan d'appui, donc des valeurs des ongles α_1, β_1, γ_1, en fonction de la position du centre du talon, de la hauteur du talon, des propriétés physico-mécaniques du matériel duquel on va former la semelle; la stabilisation du pas d'accroissement des ongles α, β, γ, dans les limites depuis 0° à 90° pour α et β, et depuis 90° à 180° pour γ; la stabilisation du contour supérieur de la cavité en fonction du modèle de l'embauchoir.

Si on trouvent toutes les variantes de modèles possibles on trouve aussi leur résolution dans le cadre d'un programme à calculateur par combinations entre les segments de droite ou arcs de cercle inclinés sous le même ongle ou sous des ongles différents.

Parmi les variantes de semelle résolues par un tel programme ou projetées par un créateur de modèles on est pour un certain nombre de modeles, et ensuite on passe à la projection et à la réalisation des pièces qui seront montées dans la matrice-mère, pour chaque modèle.

Les producteurs de semelles pourront donc aisément changer les modèles existentes déjà en fabrication quand ceux-ci sont sortis de la mode ou non, on demande

encore par la marché; tout se réduit à un simple montage de pièces, déjà confectionnées, dans une cavité.

b. *Des modifications possibles de la hauteur du talon dans une cavité-mère.* Dans la cavité-mère propre à un certain modèle de semelle, qui présente une hauteur du talon H et une hauteur au sommet h, on peut faire les modifications de la Fig. 4, par la sortie des pieces initiales 1, 2, 3, 4 et la montage a leur place des pieces $1'$, $2'$, $3'$, $4'$.

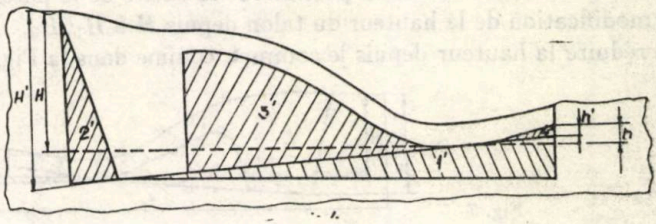

Fig. 4

On constate que, par la modification de la hauteur du talon de H à H'_n, la hauteur au sommet de la semelle se réduit conformement, depuis h a h'_n jusqu'à la limite $h'_n = 0$, avec des conséquences négatives sur la marché.

c. *Des modifications possibles dans la zone de la semelle.* Ces modifications regardent la limite de la cavité-mère dans la zone de la semelle par l'utilisation des pièces, comme la Fig. 5, qui conduiront à des formes différentes du sommet de la semelle.

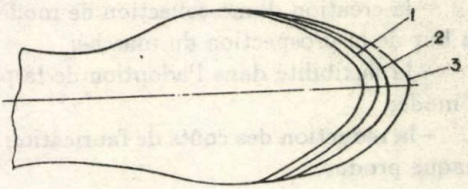

Fig. 5

d. *Des modifications possibles du relief antidérapant.* Le relief antidérapant, par sa position sur la chaussure, représente la modification la plus simple du modèle de la semelle.

Dans une cavité-mère où on a obtenu déjà la forme de la semelle, la diversification du modèle de semelle peut être réalisée, par l'utilisation des pièces qui contiennent de différents modèles de relief antidérapant, pour la même forme de la semelle.

B. **Des modifications de la cavité dans une matrice à contour donné.** Soit une matrice dont la cavité présente la forme de la Fig. 6.

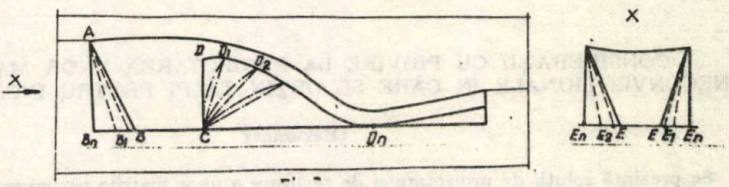

Fig. 6

Analysant quelles modifications seroit possibles à une telle matrice dans la zone du talon et de la voûte du pied.

Étudiant inversement le problème que dans le cas de la matrice-mère, on constate qu'on peut réaliser les mêmes modifications de la forme du talon et de la zone de la voûte du pied par éclatement successif de la matrice de sorte que le point B passe successivement par les points $B_1, B_2, ..., B_n$, le point D dans $D_1, D_2, ..., D_n$, le point E dans $E_1, E_2, ..., E_n$.

Une autre modification possible de la cavité de la partie postérieure est aussi la modification de la hauteur du talon depuis H à $H_1, H_2, ..., H_n$, à la conséquence de réduire la hauteur depuis le sommet, comme dans la Fig. 7.

Fig. 7

Les modifications qu'on peut réaliser dans cette variante ont un caractère limité et irréversible; aboutissant avec les modifications à la limite matrice depuis laquelle ou est parti, elle est devenue une matrice-mère.

3. Conclusions. La réalisation d'une matrice à cavité interchangeable permet:

– la création d'une collection de modèles de semelles pendant un temps court au but de la prospection du marché;

– la flexibilité dans l'adoption de la production en fonction des demandes de la mode;

– la réduction des coûts de fabrication par la diminuation des investitions pour chaque produit.

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CONSIDERAŢII CU PRIVIRE LA PROIECTAREA UNOR MATRIŢE NECONVENŢIONALE ÎN CARE SE OBŢIN TĂLPI PENTRU ÎNCĂLŢĂMINTE

(Rezumat)

Se prezintă soluţii de proiectare şi de realizare a unor matriţe neconvenţionale în care se obţin tălpi pentru încălţăminte. Aceste matriţe sunt prevăzute cu o cavitate de bază în care este posibil ca prin utilizarea unor piese interschimbabile să se realizeze diverse modele de tălpi.

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Secţia VIII
TEXTILE. PIELĂRIE

CONSIDERATION ABOUT PROPORTIONS BETWEEN SOME FOOTWEAR AND LEATHER GOODS DIMENSIONS

BY

LIVIU MĂRCUŞ and AURA MIHAI

1. Theoretical Considerations. Footwear and leather goods articles must give a sensation of pleasure first of all, sensation connected with the proportion between dimensions, with the extent of their integration with a certain clothing style and the extent of their answer to a destination (usualy, sport, special).

These elements and the degree in which they satisfy the social needs the product was projected and realised for, determine the aesthetical, functional, ergonomical, and technico-economical estimations of the product.

Being in connection with the exterior shape of product, the proportion between dimensions can be estimated by means of models.

Studies undertaken until now emphasized the existence of three models: Egyptian, European, and Indo-Tibetan. The name of these models were given by the name of the people who discovered well-known numbers in mathematics: 1.67; $\pi = 3.14$; e= 2.67.

Among these, the most used one seems to be the gold number which is:

$$R = \frac{\text{the big dimension}}{\text{the small dimension}} = \frac{5}{3} = 1.67...$$

European model, given by the number $\pi = 3.14$, will be reduced at the gold number because $\pi \simeq 2 \cdot R$, where $R = 1.67$.

2. Experimental Part

2.1. The Gold Ratio between Some Footwear Dimensions. If one analyses the exterior shape and dimensions of a footwear product, then one must consider the fact that all these are strict by dependent on the last shape and dimensions, thickness of details which compose the footwear, moulding technology, manufacturing system.

For example, two standard sizes are taken into consideration: length of the foot and breadth of toes. According to data presented in Table 1, it is noticed that especially the lasts for women footwear use this ratio.

The same proportional relations can be established also between the height of heel and the thickness of sole (Table 2). It may be used the following formula:

$$N = \frac{h}{g},$$

where: h – the height of heel [mm]; g – the thickness of sole [mm]; $N = n * R$ – multiple of $R = 5/3 = 1.67...$; n – whole number.

Table 1

Destination	Size	Series of breadth		
		4	6	8
child	11.5-19	1.154-1.401	1.310-1.316	1.060-1.320
boys and girls	19.5-26	1.373-1.501	1.335-1.467	1.300-1.430
women (height of heel h = 20 mm)	22-28	1.549-1.502	1.500-1.620	1.466-1.580

Table 2

Height	Gold proportion $R = 1.67$											
of heel	$n = 1$	$n = 2$	$n = 3$	$n = 4$	$n = 5$	$n = 6$	$n = 7$	$n = 8$	$n = 9$	$n = 10$	$n = 11$	$n = 12$
20	–	5.98	3.99	2.99	–	–	–	–	–	–	–	–
30	–	–	5.98	4.49	3.59	2.99	–	–	–	–	–	–
40	–	–	–	5.98	4.79	3.99	3.42	2.99	–	–	–	–
50	–	–	–	–	5.98	4.99	4.27	3.74	3.32	2.99	–	–
60	–	–	–	–	–	5.98	5.13	4.49	3.99	3.59	3.26	2.99
70	–	–	–	–	–	–	5.98	5.23	4.65	4.19	3.81	3.43
60	–	–	–	–	–	–	5.98	–	–	–	–	–

Considering the proportion among dimensions, not any thickness of sole will be satisfy for a given height of heel. It is easy to notice that if for heights between 30 mm and 70 mm will be adopted soles with thickness by 6, 5, 4, and 3 mm, then ratio between the height of heel and the thickness of the sole will be approximated with the gold section.

There was a time when footwear was requipped with a so-called platform, which was in fact a thicker sole.

From Table 2, one can noticed that for footwear with platform, for a certain height of heel, there are recommended certain values for the thickness of sole. So, for example, for h = 50 mm, g can be 8 or 10 mm. (Note: there have been approximated the values from the table at the whole number).

The points in Fig. 1 illustrate the situation from Table 2. One see two limited zones: the first, for small thickness, without restrictions, and the second, for big thickness of sole, with some restrictions in choosing the thickness of the sole.

The gold proportion can be taken into account also on detailing the superior ensamble of the footwear when the details dimensions are considered. For the

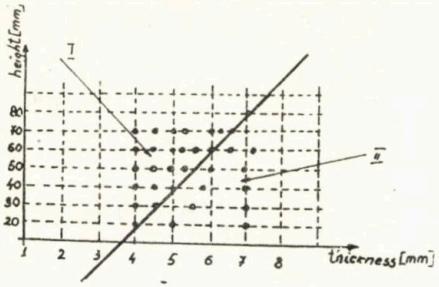

Fig. 1

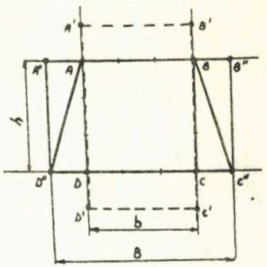

Fig. 2

estimations of the different details it is necessary from the beginning the establishment of measuring direction (for example, the line which links the tip with the point situated on 1/3 from the posterior curve of the last).

2.2. The Gold Ratio between Leather Goods Articles Dimensions. The problem of gold section can be analysed also on leather goods.

Let us consider a bag with a parallelipipedic or a piramidal shape so that the one of surfaces can be compared with a rectangle or with a trapezium. It is well-known that designing a bag must starts from the final dimensions of the product including an addision equal with the technological square. For an optimal ratio between two dimensions of a surface (length and breadth) it is advisable to make the next geometrical construction (Fig. 2):

– a square $ABCD$ with the side equal with one of the final dimensions of the product will be drawn;

– each square side will be divided into three equal segments and the segment dimensions will be noted;

– on extension of each side of the square $ABCD$, points A', A'', B', B'', C', C'', D', D'' will be found;

– if the anterior side of the product enters into a rectangle, then it is advisable to follow points A'', B'', C'', D''; in this situation we have:

$$\frac{B}{h} = \frac{5}{3} = 1.67;$$

– if the anterior side of the product enters into a trapezium, then the points to be followed are: A, B, C'', B'', when

$$\frac{B}{b} = \frac{5}{3} = 1.67 \qquad \text{and} \qquad \frac{B}{h} = \frac{5}{3} = 1.67.$$

3. Conclusions. All these considerations about the existence of an optimal ratio between dimensions of footwear or leather goods have an aspect which must be known before starting to design a new product.

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CONSIDERAŢII ASUPRA PROPORŢIILOR ÎNTRE UNELE DIMENSIUNI ALE PRODUSELOR DE ÎNCĂLŢĂMINTE ŞI MAROCHINĂRIE

(Rezumat)

Se prezintă câteva consideraţii cu privire la stabilirea unor proporţii între dimensiunile exterioare ale produselor de încălţăminte şi marochinărie, insistându-se asupra noţiunii de *secţiune de aur*.

În cazul articolelor de marochinărie se prezintă o metodă originală de stabilire a proporţiilor între lungime şi lăţime, anterior proiectării propriu-zise a produsului.

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TEXTILE. PIELĂRIE

RECHERCHES SCIENTIFIQUES CONCERNANT LES TRAITEMENTS HYDROPHOBES POUR LES TISSUS DE POLYAMIDE

PAR
ROMEN BUTNARU et DANIELA LIUŢE

1. Introduction. Les finissages hydrofuges appliqués aux textiles dans le but de réaliser une capacité hydrophobe élevée emploient des agents qui différent par leur nature chimique et par leur mécanisme d'action [1].

2. Partie experimentale. Les exigences imposées aux technologies actuelles de réalisation des indices supérieurs pour le tissu terminé avec soin doivent se trouver en corrélation avec l'emploi des paramètres optimaux de traitement dans le but d'augmenter la productivité du travail et de réduite le prix de revient. Dans ce contexte, le travail consiste à déterminer les conditions optimales de traitement hydrophobe pour les tissus de polyamide en utilisant des agents chimiques indigènes et étrangers.

Comme support textile on a employé un tissu de polyamide (Golf) préparé à l'entreprise TOMIRIS S.A., Iaşi. La technologie de finissage hydrofuge comprend les étapes suivantes:

– impregnation-pressurage avec la solution du traitement chimique dans une cuve à impregnation;

– séchage intermédiaire;

– traitement thermique de condensation à l'air chaud dans une installation Benz.

La solution du traitement chimique engendre x g/l résine Ucelone ETM, 10 g/l du catalyseur ETH et de l'acide acétique pour réaliser le pH=4,5 dans la première variante et x g/l de résine Phoboton WS, 4 g/l catalyseur UR, de l'acide acétique pour réaliser le pH=4,5 dans la deuxième variante.

Pour l'étude on a modifié les paramètres suivants:

– la concentration de la résine;

– la durée du traitment;

– le degré de pression.

La codification des paramètres et leurs limites de variation sont écrites dans le Tableau 1. Le traitement de finissage a été réalisé après un projet expérimental présenté au Tableau 2.

Tableau 1

La codification des paramètres et leur limites de variation.

	La première variante – résine Ucelone (import)					
	Codification des paramètres	−2	−1	0	+1	+2
1.	La durée du traitement thermique [s] X_1	20	30	40	50	60
2.	La température du traitement [°C] X_2	120	130	140	150	160
3.	La concentration de la résine [g/l] X_3	60	75	90	105	120
4.	Degré de pression [%] X_4	60	70	80	90	100
	La deuxième variante – résine Phoboton (Roumanie)					
	Codification des paramètres	−2	−1	0	+1	+2
1.	La durée du traitement thermique [s] X_1	20	30	40	50	60
2.	La température du traitement [°C] X_2	120	130	140	150	160
3.	La concentration de la résine [g/l] X_3	7	9	11	13	15
4.	Degré de pression [%] X_4	60	70	80	90	100

Tableau 2

Projet expérimental

Expérience nr.	x_1	x_2	x_3	x_4	Expérience nr.	x_1	x_2	x_3	x_4
1	−1	−1	−1	−1	16	+1	+1	+1	+1
2	+1	−1	−1	−1	17	−2	0	0	0
3	−1	+1	−1	−1	18	+2	0	0	0
4	+1	+1	−1	−1	19	0	−2	0	0
5	−1	−1	+1	−1	20	0	+2	0	0
6	+1	−1	+1	−1	21	0	0	−2	0
7	−1	+1	+1	−1	22	0	0	+2	0
8	+1	+1	+1	−1	23	0	0	0	−2
9	−1	−1	−1	+1	24	0	0	0	+2
10	+1	−1	−1	+1	25	0	0	0	0
11	−1	+1	−1	+1	26	0	0	0	0
12	+1	+1	−1	+1	27	0	0	0	0
13	−1	−1	+1	+1	28	0	0	0	0
14	+1	−1	+1	+1	29	0	0	0	0
15	−1	+1	+1	+1	30	0	0	0	0

Les indices testés se rapportent à la capacité hygroscopique notée Y_1 (%) et à la résistence de rupture notée Y_2 (N).

Conformément à ces valeurs en appliquant la méthode de la regression multiple

on a obtenu une série d'equations qui mettent en corrélation les indices analysés avec les paramètres étudiés [2].

3. Résultats et discussions. L'analyse des résultats peut être effectuée soit à partir des équations de régression soit à partir de leurs graphiques.

Dans le Fig. 1 on représente ainsi les variations de la capacité hydroscopique Y_1 et de la résistence de rupture Y_2 qui se rapportent aux paramètres de l'operation.

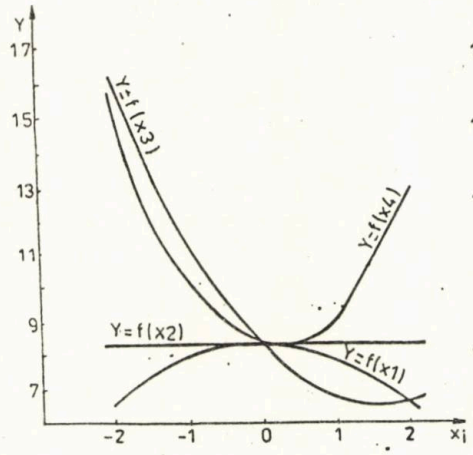

Fig. 1.– La variation de la capacité hygroscopique pour le tissu de polyamide traité avec la résine Ucelone se rapporte aux paramètres étudiés.

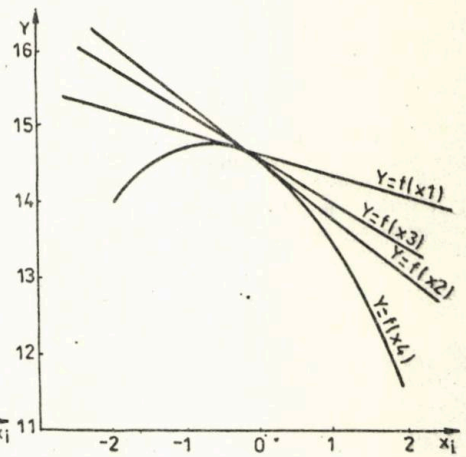

Fig. 2.– La variation de la capacité hygroscopique pour le même tissu de polyamide traité avec la résine Phoboton se rapporte aux paramètres étudiés.

Des Figs. 1 et 2 il résulte que le principal paramètre qui influence la capacité hygroscopique est la concentration de la résine. Ainsi, quelque soit le type de la résine, la capacité hydrofuge s'améliore en même temps que l'augmentation de la concentration. En revanche, la durée et la température du traitement influencent moins cet indice.

En ce qui concerne la résistance de rupture dont sa variation est réprésentée dans les Figs. 3 et 4, on peut constater que les deux sortes de résine influencent différemment cet indice.

En cas d'emploi de la résine Ucelone la durée du traitement et la concentration de la résine ont ainsi une influence négative tandis que la température et le degrée de pression ont une influence positive.

Pour la résine Phoboton seulement la durée du traitement a une influence négative tandis que les autre paramètres ont une influence insignifiante.

Ces résultats peuvent être expliqués par la structure chimique différente de ces deux substances utilisées. La résine Ucelone est ainsi une émulation silicone tandis que la résine Phoboton est un complexe de stéarat de chrome (composé organo-métallique).

La résine Ucelone actionne par la constitution des pellicules fortement adhérentes à la fibre de laquelle elles se fixent par des liaisons de hydrogène et

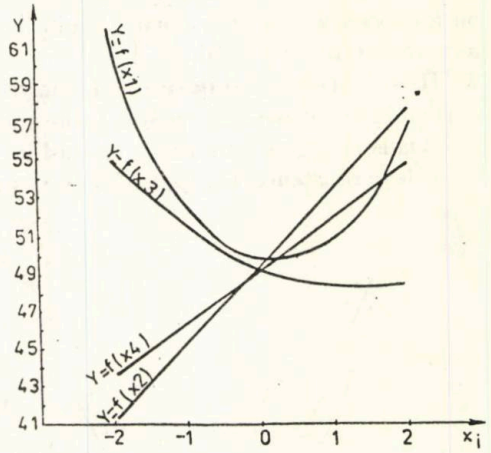

Fig. 3.– La variation de la résistence de rupture pour le tissu de polyamide traité avec la résine Ucelone se rapporte aux paramètres étudiés.

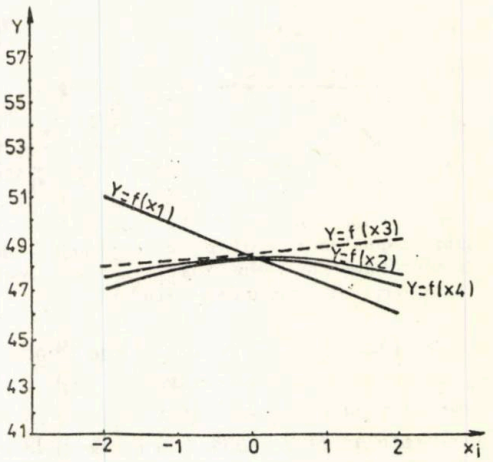

Fig. 4.– La variation de la résistence de rupture pour le même tissu de polyamide traité avec la résine Phoboton se rapporte aux paramètres étudiés.

forces Van der W a a l s tandis que la résine Phoboton polymérise à l'intérieur de la fibre en formant des liaisons intermoléculaires [3].

De l'analyse de la variation de ces deux indices étudiés par l'intersection de plusieurs courbes qui correspondent à un tissu et à ses conditions de traitement s'ensuit que l'interval optimal pour l'obtention d'une capacité hygroscopique diminuée correspond à une augmentation de la résistance de rupture.

a) en cas d'emploi de la résine Ucelone:
- la concentration de la résine 9 g/l;
- la température de condensation 140°C;
- la durée du traitement thermique 40 s.

b) en cas d'emploi de la résine Phoboton:
- la concentration de la résine 15 g/l;
- la température de condensation 160°C;
- la durée du traitement thermique 60 s.

4. Conclusions. 1. On a effectué des traitements hydrophobes pour les tissus de polyamide en employent deux sortes de résines: Ucelone (import) et Phoboton (Roumanie).

2. Par la méthode de la régression multiple on a trouvé les conditions optimales de travail pour l'obtention d'une capacité hydrofuge maximale avec la conservation de l'integrité du support textile.

3. On a pu donc conclure que l'emploi de la résine Phoboton convient d'avantage que celui de la résine Ucelone.

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CERCETĂRI PRIVIND TRATAREA HIDROFOBĂ A MATERIALELOR TEXTILE DIN POLIAMIDĂ

(Rezumat)

Se prezintă rezultatele obţinute la tratarea hidrofobă a materialelor textile din poliamidă, folosind două răşini: una de tip siliconic (Ucelone ETH) şi cealaltă de tip organo-metalic (Phoboton WS). S-a constatat că indicele ce caracterizează capacitatea de respingere a apei este mult mai bun în cazul folosirii răşinii siliconice în timp ce rezistenţa la rupere este mai mică decât în cazul folosirii răşinii Phoboton. Sunt prezentate condiţiile optime de tratare cu cele două tipuri de răşini pentru a se obţine indicii maximi de hidrofobizare: capacitatea de respingere a apei şi rezistenţa la rupere.

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INVESTIGATION OF THE DEPENDENCE BETWEEN THE DEGREE OF WHITENESS OF THE FLAX FIBERS EXTRACTED FROM UNRETTED STEMS AND SOME WORKING PARAMETERS OF THE BLEACHING PROCESS

BY
ADRIANA MUSTAŢĂ

1. Introduction. In the opinion of several specialists, [1],...,[3], the degree of whiteness resulted from bleaching processes is of special importance as assuring dyeing of the fibers in light shades or their processing as white materials.

The degree of whiteness is influenced by all factors known as having oxidating effects upon the product, as well as by thermal actions, by the duration of the bleaching agents action, a.s.o. [1].

2. Experimental. In this stage of the experiments, optimization of some working parameters of the process of unretted flax fibers bleaching has been considered for the obtainment of a certain degree of white, this value has been determined by means of a leucometer, applied to fibers bleached in the experimental variants listed in Table 1. The degree of white meseaures the factor of diffused reflection of the textile fabric against that of a control surface as to magnesium oxide. The independent parameters taken into consideration have been the following: concentration of the solution of bleaching with hydrogen peroxide (e), concentration of the solution of bleaching with sodium hypochlorite (f), temperature of the solution of bleaching with H_2O_2 (g), duration of the bleaching reaction (h).

3. Results and Discussion. The experimental data presented in Table 1 have been processed by dispersional and regression analysis methods; checking of the significance of the regression coefficients by the t test, for the degree of white of bleached fibers of unretted flax fibers, led to the following equation:

$$y = 49.1 + 0.084e + 0.315g + 0.161h - 1.6e^2 - f^2 - 1.34g^2 - \\ - 1.95h^2 + 1.875ef - 0.6125eg - 1.3eh + 0.86fh - 0.63gh \tag{1}$$

Equation (1) expresses satisfactorily the relation between variables, because the differences between the measured and the estimated (y) values are below 10% (Table 1), while the calculated values of the Snedecor-Fisher test,

Table 1

The Degree of White of the Bleached Fibers of Unretted Flax. Experimental Program

No.	e_{coded}	f_{coded}	g_{coded}	h_{coded}	e	f	g	h	The fibers degree of white	
					ml/l	ml/l	°C	hours	$y_{measured}$	$y_{calculated}$
1	−1	−1	−1	−1	75	42	37	2	43.2	42.84
2	1	−1	−1	−1	105	42	37	2	40.1	43.08
3	−1	1	−1	−1	75	61.9	37	2	34.7	37.37
4	1	1	−1	−1	105	61.9	37	2	45.4	45.11
5	−1	−1	1	−1	75	42.3	72	2	49.3	45.96
6	1	−1	1	−1	105	42.3	72	2	49.0	43.75
7	−1	1	1	−1	75	61.9	72	2	40.0	40.49
8	1	1	1	−1	105	61.9	72	2	48.2	45.78
9	−1	−1	−1	1	75	42.3	37	4	42.0	45.30
10	1	−1	−1	1	105	42.3	37	4	40.5	40.35
11	−1	1	−1	1	75	81.9	37	4	43.3	43.27
12	1	1	−1	1	105	61.9	37	4	41.6	45.82
13	−1	−1	1	1	75	42.3	72	4	48.1	45.89
14	1	−1	1	1	105	42.3	72	4	40.3	38.49
15	−1	1	1	1	75	61.9	72	4	46.0	43.87
16	1	1	1	1	105	61.9	72	4	46.1	43.96
17	−2	0	0	0	60	53.9	54	3	42.7	42.53
18	2	0	0	0	120	53.9	54	3	41.2	42.86
19	0	−2	0	0	90	30.8	54	3	42.9	45.10
20	0	2	0	0	90	76.0	54	3	47.7	45.10
21	0	0	−2	0	90	53.9	20	3	45.3	43.11
22	0	0	2	0	90	53.9	90	3	40.7	44.37
23	0	0	0	−2	90	53.9	54	1	36.6	40.98
24	0	0	0	2	90	53.9	54	5	44.5	41.62
25	0	0	0	0	90	53.9	54	3	48.5	49.1
26	0	0	0	0	90	53.9	54	3	49.0	49.1
27	0	0	0	0	90	53.9	54	3	49.5	49.1
28	0	0	0	0	90	53.9	54	3	50.9	49.1
29	0	0	0	0	90	53.9	54	3	48.6	49.1
30	0	0	0	0	90	53.9	54	3	48.6	49.1
31	0	0	0	0	90	53.9	54	3	48.8	49.1

comparing – in this case the experimental dispersion and the regression deviation is of 2.5 for $\nu_1 = 30$, $\nu_2 = 30$ as compared with 1.84 – the value of test F, tableted for the same degrees of freedom and for a statistic certainty of 95%.

For better evidencing the influence of the independent parameters considered on the whiteness degree of the fibers extracted from unretted flax stems, two variables have been considered at a time, the others being given the values corresponding to the stationary point, representing a maximum, having the following coordinates: $e_{cod} = 0.082$; $f_{cod} = 0.058$; $g_{cod} = 0.097$; $h_{cod} = -0.044$. As one may

observe, the maximum value of the whiteness degree of the fibers of the unretted flax is obtained for values of the independent variables situated in the vicinity of the experiment center.

Analysis of the influence exercised by the concentration of the solution of bleaching with hydrogen peroxide (e) and of its temperature (g), upon the degree of white of the unretted flax (Fig. 1) shows that, out of the two above mentioned independent parameters, a higher influence on the degree of white is exercised by the concentration of the hydrogen peroxide. On employing a temperature of the bleaching solution with hydrogen peroxide (35%, 90 ml/L) of 54°, with 2 g/L active chlorine – concentration of the bleaching solution with sodium hypochlorite, and a total duration of the bleaching reaction of 3 hours, a degree of white of the unretted flax fibers corresponding to a factor of diffused reflection of 50 is obtained.

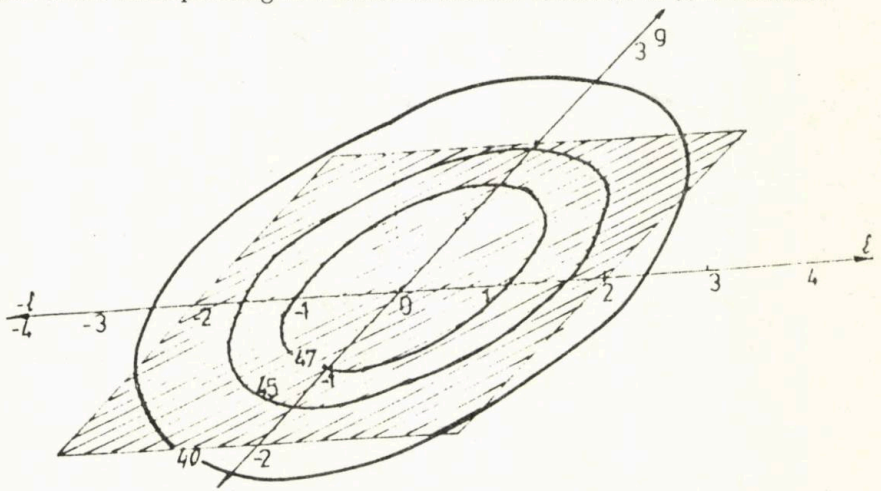

Fig. 1.– Constant-level curves of the degree of white of unretted fibers of bleached flax, as depending on the concentration of the hydrogen peroxide solution (e) and on its temperature (g).

Fig. 2 evidences the higer influence exercised on the degree of white of the fibers extracted from unretted flax fibers by the concentration of the bleaching solution with hydrogen peroxide, as compared to that employing sodium hypochlorite – which has been already aproved [4] for cotton fabrics. In such a case, the maximum degree of white is obtained when applying the conditions in the center of the experiment.

As to the influence of the temperature of the bleaching solution with hydrogen peroxide, (g), and of the duration of the bleaching process, (h), upon the degree of white of the unretted flax fibers, Fig. 3, the observation to be made is that both parameters influence the degree of white to an equal extent.

Therefore, the general conclusion to be drawn is the elimination of retting, and its substitution with a bleaching process, controlled and managed scientifically, may constitute one of the ways of removing the seasonal character of flax

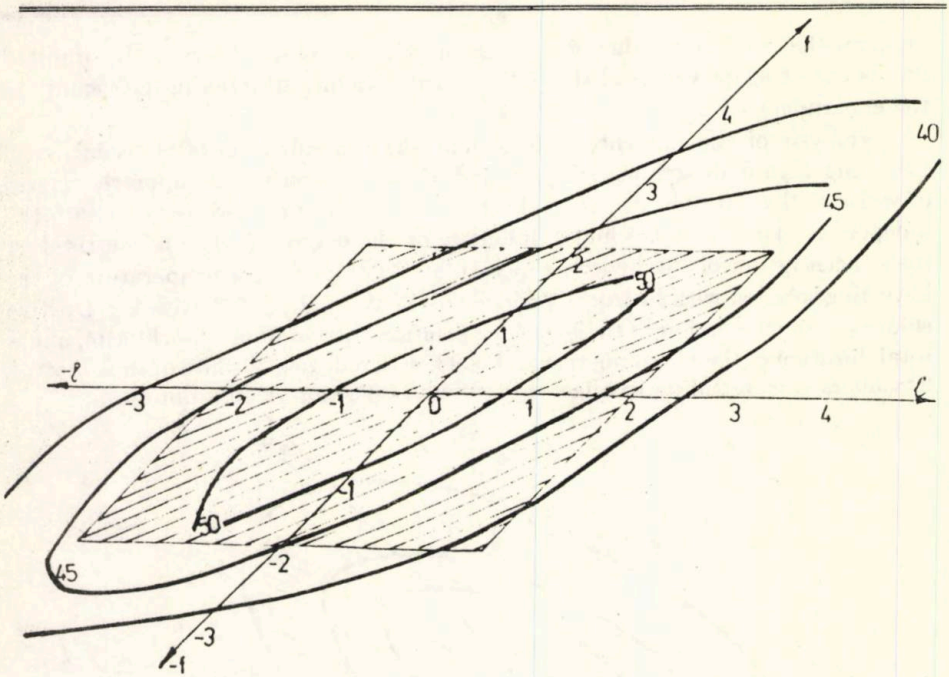

Fig. 2.– Constant-level curves of the degree of white of unretted fibers of bleached flax, as depending on the concentration of the bleaching solution with hydrogen peroxide (e) and on the concentration of sodium hypochlorite solution (f).

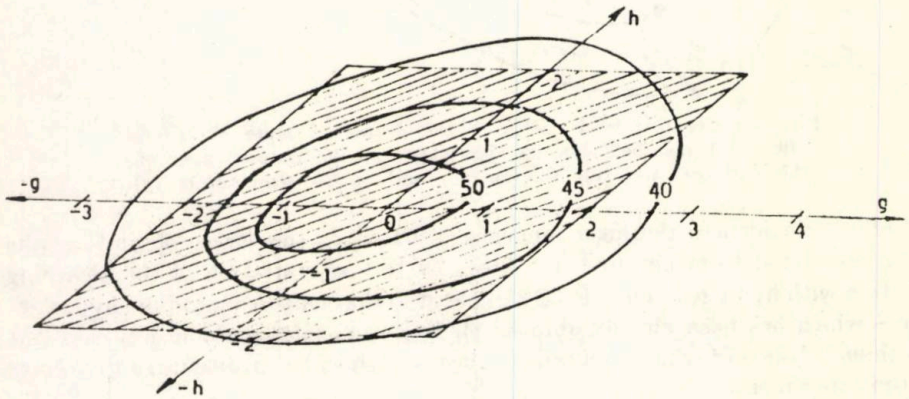

Fig. 3.– Constant-level curves of the degree of white of unretted fibers of bleached flax, as depending on the temperature of the bleaching solution with hydrogen peroxide (g) and on the duration of the bleaching proccess (h).

preindustrialization processes, as well as of improving the fibers extracted from unretted flax stems.

The second stage of investigations aimed at optimizing the bleaching conditions

of the unretted flax fibers, with a view to increasing their degree of white. In this respect, previous researches have established as optimum for the degree of white of bleached fibers of unretted flax the following conditions: concentration of the bleaching solution with sodium hypochlorite of 1.2 g/L active chlorine, and of 90 ml/L – of the hydrogen peroxide 35%. These parameters have been kept constant in all the experiments of this series, the objective of which has been to establish a multiple simultaneous correlation between the fibers degree of white, on one side, and the total duration of the bleaching reaction, temperature of the bleaching solution with hydrogen peroxide, concentration of the sodium sulphite solution – on the other side.

In order to observe the variation of the whiteness degree of the unretted flax fibers of the Hera Kind (the region of Joseni), bleaching with sodium hypochlorite has been applied, followed by washing with cold water, for 10 minutes, treatment of the fibers with sodium sulphite, washing with water at 70°, again for 10 minutes, bleaching with hydrogen peroxide and another washing with water at 65°, for 10 minutes, and, finally, a 10 minutes washing with cold water.

Codification of the independent variables and selection of the interval of their variation are presented in Table 2. The temperature of the bleaching solution with sodium hypochlorite was of 20-25°. The fibers employed in the experiment have been supplied by the C-460-L_2 card, their content in adhering impurities being of 6.25%.

Table 2

Codification of the Independent Variables and Selection of their Variation Interval

No.	Independent variable	Level of the variables					
		Cod	−1.682	−1	0	1	1.682
1.	Concentration of the solution of sodium sulphite, %	l	0.25	0.40	0.62	0.85	1.0
2.	Total duration of the bleaching reaction, min.	h	30	50	75	100	120
3.	Temperature of the bleaching solution with hydrogen peroxide, 35%, °C	g	30	42	60	78	90

The ratio of the bleaching bath was – as in the previous investigations – of 1:10.

Programming of the experiments involved 20 variants, 6 experiments being performed in the center of the experiments (Table 3).

The coefficients of the regression equation have been determined by the method of the least squares.

The graph plotted in Fig. 4 evidences the fact that, in the experimental domain considered, a great influence is manifested upon the degree of white of the unretted flax fibers by the duration of the bleaching process (h), as compared to the concetration of the sodium sulphite solution (l), when the temperature of the solution of bleaching with 35% hydrogen peroxide is of 38°C, in this case, the

Table 3

The Degree of White of the Bleached Fibers of Unretted Flax. Experimental Program

No. of variant	l_{coded}	h_{coded}	g_{coded}	l_{real} %	h_{real} min.	g_{real} °C	The fibers degree of white	
							$y_{measured}$	$y_{estimated}$
1	−1	−1	−1	0.40	50	42	53.870	50.984
2	1	−1	−1	0.85	50	42	57.470	54.176
3	−1	1	−1	0.40	100	42	55.150	55.622
4	1	1	−1	0.85	100	42	52.830	54.038
5	−1	−1	1	0.40	50	78	53.670	50.886
6	1	−1	1	0.85	50	78	48.950	48.904
7	−1	1	1	0.40	100	78	58.020	59.747
8	1	1	1	0.85	100	78	55.670	54.982
9	−1.682	0	0	0.25	75	60	52.170	54.953
10	1.682	0	0	1.00	75	60	53.900	53.630
11	0	−1.682	0	0.62	30	60	43.520	48.121
12	0	1.682	0	0.62	120	60	57.820	55.451
13	0	0	−1.682	0.62	75	30	51.470	54.857
14	0	0	1.682	0.62	75	90	56.170	55.730
15	0	0	0	0.62	75	60	54.210	55.294
16	0	0	0	0.62	75	60	56.500	55.294
17	0	0	0	0.62	75	60	54.700	55.294
18	0	0	0	0.62	75	60	56.470	55.294
19	0	0	0	0.62	75	60	54.150	55.294
20	0	0	0	0.62	75	60	55.200	55.294

Obs: l – concentration of the sodium sulphite solution, %; h – duration of the treatment with sodium sulphite, min.; g – temperature of the bleaching solution with hydrogen peroxide, °C.

naximum value of the degree of white, (y), corresponding to a factor of diffused eflection of 55 is reached near the center of the experiment.

The study – in the new working conditions required of the simultaneous influence of the total duration of the bleaching reaction (h) and of temperature of he bleaching solution with 35% hydrogen peroxide (g) upon the whiteness degree f the unretted flax fibers, (Fig. 5) – evidences the inderdependence of the action f the two above mentioned parameters, (h) and (g). Another observation is that he total duration of the bleaching reaction influences the fibers degree of white o a higher extent than the temperature of the bleaching solution with hydrogen eroxide.

The maximum degree of white corresponding to a factor of diffuse reflection of 6, that may be obtained in this case in the experimental domain involves similar onditions to those from the center of the experiment.

The graph plotted in Fig. 6 expresses the simultaneous influence upon the legree of white of bleached fibers of unretted flax – of the concentration of the odium sulphite solution (l) and of the temperature of the bleaching solution with

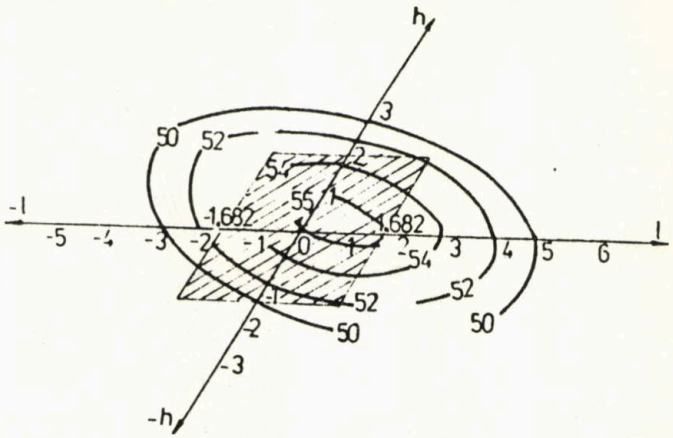

Fig. 4.– Constant-level curves of the degree of white of unretted fibers of bleached flax, as depending on the duration of the bleaching process (h) and on the concentration of the sodium sulphite solution (l).

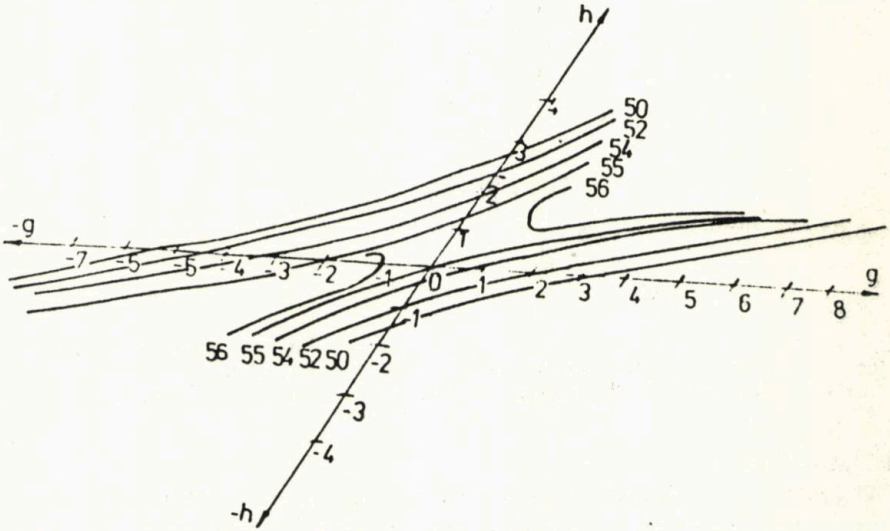

Fig. 5.– Constant-level curves of the degree of white of unretted fibers of bleached flax, as depending on the total duration of the bleaching reaction (h) and on the temperature of the bleaching solution with hydrogen peroxide 35% (g).

hydrogen peroxide (g), as well, when the total duration of the bleaching reaction is of 75 minutes.

For total durations of the bleaching reaction ranging between 30 and 70 minutes, as well as for temperatures of the bleaching solution with hydrogen peroxide between 30-60°C (Fig. 7), a greater influence upon the degree of white is played

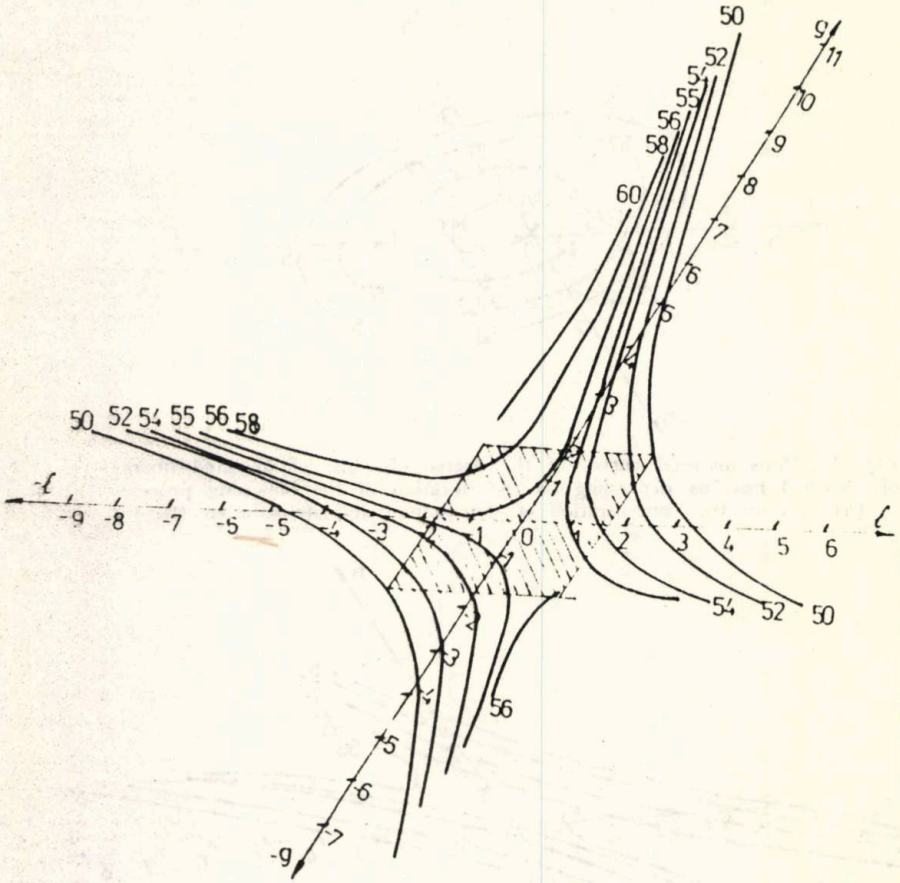

Fig. 6.– Constant-level curves of the degree white of unretted fibers of bleached flax, as depending on the concentration of the sodium sulphite solution (l) on the temperature of the bleaching solution with hydrogen peroxide (g).

by the latter parameter.

Within the experimental domain, where the temperature of the bleaching solution with hydrogen peroxide ranges between 60 and 90°, the total duration of the bleaching reaction takes values between 70 and 120 minutes, while the concentration of the sodium sulphite solution ranges between 0.62 and 1%, a stronger influence, upon the whiteness degree of the bleached fibers of unretted flax being exercised by the total duration of the bleaching reaction.

4. Conclusions. 1. Under conditions corresponding to the center of the experiment, that is concentration of the sodium sulphite solution of 0.62%, total duration the bleaching reaction of 70 minutes and temperature of the bleaching solution, with hydrogen peroxide of 60°, it is possible to obtain, for bleached fibers of unretted flax, a degree of white corresponding to a factor of diffuse reflection of

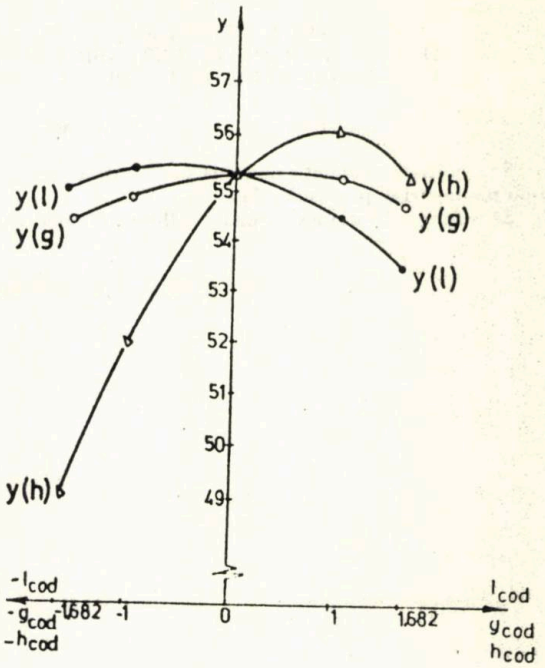

Fig. 7.– The simultaneous influence upon the degree of white of bleached fibers of unretted flax of the concentration of the sodium sulphite solution (l), of the temperature of the bleaching solution with hydrogen peroxide 35% (g) and of the total duration of the bleaching reaction (h).

55.29 and a content in lignin and ashes of 4.7%. The average content in lignin of unretted flax fibers used in the experiment was of 7.8%.

2. All the above mentioned ideas support the possible bleaching of unretted flax fibers with a solution of 35% hydrogen peroxide at a temperature below 90°, a value applied nowadays in the finishing operations of flax products.

3. Utilization of constant-level curves, determined from experimental data, permits the establishment of the working conditions for bleaching of unretted flax, a certain value of the degree of white being thus obtained.

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CERCETAREA DEPENDENŢEI DINTRE GRADUL DE ALB AL FIBRELOR DE IN EXTRASE DIN TULPINI NETOPITE ŞI UNII PARAMETRI DE LUCRU AI PROCESULUI DE ALBIRE

(Rezumat)

Se stabileşte o corelaţie multiplă simultană între gradul de alb al fibrelor albite de in netopit şi unii parametri ai procesului de albire.

Se precizează varianta optimă de albire a fibrelor netopite de in cu privire la gradul de alb.

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TEXTILE. PIELĂRIE

STUDIES ON CHEMICALLY MODIFIED VEGETALE PROTEINS IN WOOL ANTI-MOTHS TREATMENTS

BY
AURELIA GRIGORIU, CARMEN MOROŞAN and BUJOR DRAGOMIR

1. Introduction. From all fibers, wool is considered as the most exposed to attack by moths destructive action.

Besides the well known species of moths (*Tineola bisselliella, Trichophaga tapetzella, Tinea pellionella, Hofmanophila pseudospretella*), new ones appeared showing a great resistance to the treatments usually applied [1],...,[3].

Practically, moths' action occurs on the cellular membrane, the more precisely, on the disulphidic chains of wool materials, inducing subsequent chemical and enzymatic attack [4].

Depending on their action, the treatments against moths involve respiration, digestion and contact substances [5].

Among the products known as having a moth-proofing action, mention may be made of: Eulan assortments (such as BLS, U33, WA, N) and Movin DC of Bayer's, Mitin ranges (such as FF, LA, LP), Dieldrin, Tinosan SL-DP of Ciba Geigy's, Molantin P of TRC Pty. Ltd.'s Melbourne.

The paper aims at introducing chemically modified vegetale proteins in treatments of wool protection against moths.

The chemically modified vegetale proteins were firstly obtained in Romania, are available on an industrial scale and are known as PT-2a (powder) and PT-2b (aqueous solution) [6].

The chemically modified vegetale proteins are nontoxic and cheaper than other products used in treatments against moths.

The chemically modified vegetale proteins used in this study were not tested in textile field till now, their application is part of the environmental protection programme developed in Romania today.

2. Experimental

Materials. The chemically modified vegetale proteins were purchased from "P.Poni" Institute of Macromolecular Chemistry, Jassy; they are copper complex of proteic juice, resulted through potato and tomato stems screwing. The chemically modified vegetale proteins contain min. 0.3% proteic substances ($N\% \times 6.25$) and min. 0.2% copper.

Methods. In laboratory experiments, Romanian Merino wool tows (23.4 μm) were placed on a glass support with ten moth larves. The chemically modified vegetale proteins, Dieldrin, Mitin FF, naphtaline treated wool were maintained at 30°C, 65% relative humidity, for four weeks.

Based on the obtained laboratory results, industrial treatments against moths have been applied on greasy wool, as well as on wool fabrics.

Greasy tzurcana wool (250 kg) was treated through scattering with PT-2a powder and then a ballot was made; it was covered with a thin polyethylene sheet, being subjected to analyses on the loss of mass, for four weeks.

PT-2b, aqueous solution, was tested on wool-like fabrics (70-100% wool and chemical fibers); a 30-40% PT-2b solution was employed, at the room temperature.

The chemically modified vegetale proteins are the ideal compounds that should be applicable in a normal process (e.g., washing, felting, softening, dyeing) and have no effect on mill effluent.

Analytical procedures. The evaluation of moth resistance was made by estimating the amount of feeding damage by the moth larvae on the non-treated and treated wool samples. The wool samples were weighed and placed in glass dishes, 4.5×1.5 cm, together with 10 test insects (25 days-old larvae of *Tineola bisselliella* and 30 days-old larvae of *Tinea pellionela*; in general, similar damage is caused by both larvae). Ten dishes were prepared for each experiment and placed at 30°C, 65% RH, in the dark. Weekly estimation of the weight of the wool samples were made for four weeks. Decrease in the weight of wool samples was taken as the amount of feeding damage.

Firstly, the washing stability of the tested products was determined.

There was also determined the mechanical characteristics on rheological curves, the nitrogen content (Parnas–Wagner method), the copper content in wool and in waste water, cysteic acid contents, the alkali and urea-bisulphite solubility and the electrokinetic (ζ) potential.

3. Results and Discussion. Mass wool losses in moth proofing treatments and the stability to wash are presented in Table 1.

On the basis of mass wool losses and visual observation, after two weeks from the chemically modified vegetale proteins treatment, no larves or moth butterflies were observed.

The feeding therefore does not continue longer than one or two weeks and the amount of the damage is determined in this period.

The amount of damage is limited to a certain extent by the shortness of their larval period (about 32 days for *Tineola bisselliella* and 42 days for *Tinea pellionella*).

When the feeding experiments were started from an earlier larval period, the damage in lower concentrations of the agents would be some what greater, but in higher concentrations would be the same, or even less, than that done by the older larvae used in the present experiments.

When experiments were conducted with hewly hatched larvae, the feeding damage in higher concentrations was smaller owing to higher mortality, and in

Table 1

Mass Wool Losses in Moth-proofing Treatments

No.	Treatment	Conc.	Mass wool losses				Stability
			1st week	2nd week	3rd week	4th week	to wash
		%	%	%	%	%	
A. Romanian Merino Wool Fibers (23.4 μm)*							
1.	Untreated	–	22.0	43.0	62.0	81.0	–
2.	Dieldrin	0.5	1.8	1.8	3.4	5.1	2
3.	Mitin FF	0.8	1.5	3.8	4.5	5.3	5
4.	Naphtaline	2.0	3.5	8.7	13.5	22.4	1
5.	PT-2a	1.5	1.5	3.5	4.1	5.4	5
6.	PT-2b	1.3	1.3	1.1	3.2	3.8	5
B. Romanian Tzurcana Wool Fibers (40 μm)**							
7.	Untreated	–	19.5	22.0	17.5	16.0	–
8.	PT-2a	1.5	2.3	2.5	1.4	1.5	5
C. 100% Wool fabric (980 g/m)**							
9.	Untreated	–	35.0	40.0	56.0	72.0	–
10.	PT-2b	1.3	2.5	2.8	1.0	0.8	5
D. 70/20/10 wool/polyamide/rayon (782 g/m)**							
11.	Untreated	–	21.0	38.0	52.0	58.0	–
12.	PT-2b	1.3	3.0	4.1	2.5	1.2	5

* laboratory experiments; ** industrial experiments.

lower concentrations, the amount was smaller because of lower feeding amount than those done by the older larvae.

The amount of damage differed with the fabric structure as well as with the fiber substance. Blended yarn was completely eaten by the larvae, with no particular selection of wool from chemical fiber. The damage was greater with fiber than with cloth.

The efficiency of wool treatment with chemically modified vegetale proteins is comparable to that with Mitin FF.

The tensile properties and chemical characteristics of chemically modified vegetale proteines treated wool are presented in Table 2.

Based on data presented in Table 2 it can be observed the following:

– the chemically modified vegetale proteins treated fibers increased about 10-20% in stregth and in elongation, showing that chemically modified vegetale proteins treatment improved the mechanical properties of wool;

– the chemically modified vegetale proteins treated fibers increased about 12% in nitrogen content, showing that chemically modified vegetale proteins were fixed on wool;

– the presence of copper in chemically modified vegetale proteins treated wool is due of the metal (copper) crosslinkings;

– there should be no possibility of toxic compounds remaining in the mill effluent and affecting fish or other life in steams;

– the chemically modified vegetale proteins treated fibers increased about 27%

Table 2

Comparison of Characteristic Properties between Chemically Modified Vegetale Proteins Treated and Untreated Wool Fibers (23.4 μm)

No.	Characteristics	U.M.	Untreated wool	PT-2b treated wool
	A. Mechanical characteristics			
1.	Thickness	tex	0.542	0.539
2.	Young modulus (E)	cN/tex	225.000	350.600
3.	Effort for elasticity	cN/fiber	4.987	5.628
4.	Deformation for elasticity	%	4.089	5.978
5.	Effort for flowing	cN/fiber	7.175	8.616
6.	Deformation for flowing	%	18.946	22.240
7.	Effort for tearing	cN/fiber	7.217	8.881
8.	Deformation for tearing	%	19.976	22.496
9.	Tenacity	cN/tex	13.315	16.476
	B. Chemical Characteristics			
10.	Nitrogen contents in wool	%	14.700	16.500
11.	Copper contents – in wool	%	–	0.260
	– in waste water	%	–	25.770
12.	Cysteic acid contents	%	12.100	11.600
13.	Alkali solubility	%	16.600	8.500
14.	Urea-bisulphite solubility	%	48.800	22.100
	C. Electrokinetics characteristic			
15.	Electrokinetic (ζ) potential	mV	-3.200	-2.320

in electrokinetic (ζ) potential, showing that the chemically modified vegetale proteins, which are electropositive, were fixed especially on –COOH, –SH, –OH groups.

On the basis of this results, subsequent observations can be made:

– the chemically modified vegetale proteins are substantive for wool, due to hidroxylic and aminic groups;

– the chemically modified vegetale proteins protection on wool is due to amino acid: asparagic acid, threonine, serine, glutamic acid, proline, glycine, alanine, cystine, valine, methyionine, isoleeucine, leucine, tyrosine, phenylalanine, histidine, lycine, arginine, that are in chemically modified vegetale proteins and in wool; the chemically modified vegetale proteins action on wool is not comparable to the common insecticides;

– the chemically modified vegetale proteins are able to consolidate the disulphidic crosslinkings with copper W–S–Cu–S–W; so the chemically modified vegetale proteins treated wool will determine the diminution of reduction cystine crosslinkages by enzymes in the larval gut.

4. Conclusions. The chemically modified vegetale proteins, named PT-2a (powder) and PT-2b (aqueous solution), were introduced in wool protection against moths; they are nontoxic, cheaper than other products used in treatments against moths and they are applicable in a normal process (e.g., washing, felting, softening, dyeing).

The chemically modified vegetale proteins treated fibers increase about 10-12% in strength and in elongation, showing that chemically modified vegetale proteins treatment improve the mechanical properties of wool.

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STUDII ALE PROTEINELOR VEGETALE MODIFICATE CHIMIC ÎN TRATAMENTELE DE PROTEJARE A LÂNII ÎMPOTRIVA MOLIILOR

(Rezumat)

Proteinele vegetale modificate chimic (obţinute din stoarcerea lujerilor de cartofi, roşii şi apoi complexate cu cupru) protejează lâna împotriva acţiunii moliilor; eficienţa acestor produse este comparabilă cu a produsului Mitin FF.

Proteinele vegetale modificate chimic nu au mai fost utilizate în domeniul textil, sunt netoxice şi de 10-100 ori mai ieftine decât produsele curent utilizate pentru combaterea moliilor.

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Secţia VIII
TEXTILE. PIELĂRIE

THE GRAPH TIME/PERFORMANCE FOR QUALITY ASSURANCE OF TRAINING IN CLOTHING INDUSTRY

BY
COSTACHE RUSU and I. VERZEA

1. General Appreciation about the Quality of Employee Training in Clothing Industry. Quality is the main factor which assures the survival of the firm in a free economy. That is why we need good employees, with good working skills. In the clothing industry, where the work is especially manual or manual-mechanical, the employees' skill is the main factor which assures manufacturing products with good quality. The abilities of employees must be gathered and, for this reason, we need good instructors. The problem is to find the way for a good and performance based training.

If training occurs in the production line, we have no advantages because: the operation has a low quality, there are many mistakes during the work process, there are a lot of rejections, and it results in low productivity levels.

If training occurs in the workshops of the firm, we spend money with the depreciation of equipment of the workshops because they are unproductive and also the payment of instructors must be figured in.

2. A Method for Monitoring the Employees Performances During the Training Period. The method tests all employees who are working at the sewing machines during the training activity. The method uses 6 form-tests, which consist of sewing outlines. The level of performances is given by the quality of sews and the sewing time. The test must be repeated regularly and the outcomes must be put in the time vs. performance graph which has, for a good training, the form in Fig. 1.

We can draw the graph for the employees during the training activities, for the employees during the work in production activities, or for selecting of the human resources.

If we have a time vs. performance graph which reflects the medium level of performance of the employees, we may use it in recruting new employees. We can choose manufacturing activities for the employees which achieve the level of performance from the reference graph. The employees who are not able to achieve the level from the reference graph, must be eliminated.

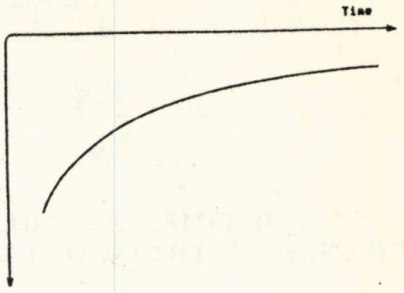

Fig. 1.– The time vs. performance graph.

3. The Form-Tests. In order to establish the level of performances, we use the following 6 form-tests (Fig. 2):

1. accurate stopping;
2. full speed treadle control;
3. speed and straight line accuracy;
4. needle down turn;
5. judging stops and turns;
6. control sewing at full speed.

4. Measurements, Gathering and Processing Data. Each form-test must be drawn on the textile material, from A4 (21.4 × 29.6 cm), with chalk or a ball-point pen. The group of employees must use a textile material with the same structure and thickness and they must use the same material during the whole experiment. Also, the sewing step must be constant and we need to use the same equipment. The sews can be made with yarns which have different colours (one color for each form-test), in order to use the same piece of material for many form-tests, which facilitates processing of the data.

Each employee must do 6 sews for each form-test, which from the best 3 will be taken into account (we need 36 mesurements/person). The objectives of the employees during the test must be the sewing time and the sew quality.

For each sew we must register the sewing time and we must appreciate the sew quality. We appreciate the sew quality according to the percentage of good or bad quality. All the results can be noticed in Table 1, where T_{ijk} is the time for the sew i, on the form-test j, in the training stage k; C_{ijk} – the appreciation of quality, for the sew i, on the form-test j, in the training stage k (for ex.: if 20% of the sew has a bad quality, $C_{ijk} = 80\%$); P_{ijk} – performance of the sew i, on the form-test j, in the training stage k, $P_{ijk} = T_{ijk}/C_{ijk}$; P_{jk} – the medium performance of the form-test j, in the training stage k, for the first 3 performances of sews/form-test; P_{mtk} – the total medium performance, in the training stage k, $P_{mtk} = (P_{1k} + P_{2k} + \cdots + P_{6k})/6$.

The best results are those with the minimal score, and for calculating P_{jkl} we have considered the first 3 sews with the minimal score.

In order to apply this method, we used some students from the first stage of the Textile and Leather Faculty In Iaşi, during their 3 weeks of practical work.

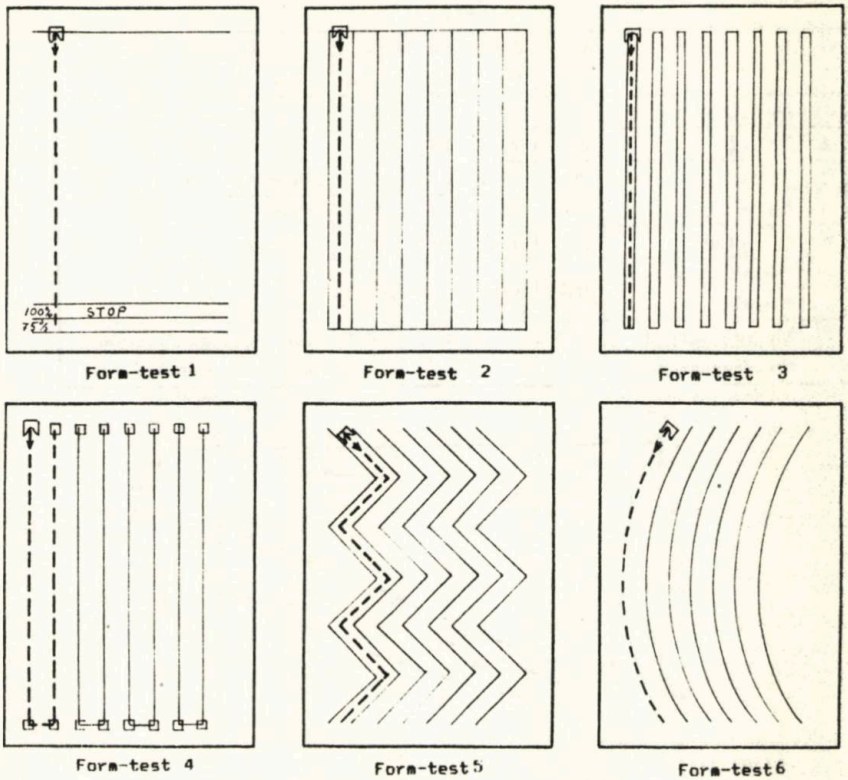

Fig. 2.– The form vs. tests.

Table 1

WORKSHEET DATA

Machine.....
Sew.....
Date.....

Name.....
Training stage.....
Age/experience.....

No.	Sew 1			Sew 2			Sew 3			Sew 4			Sew 5			Sew 6			P_{jk}
	T_{ijk}	C_{ijk}	P_{ijk}	T_{ijk}	C_{ijk}	P_{ijk}	T_{ijk}	C_{ijk}	P_{ijk}	T_{ijk}	C_{ijk}	P_{ijk}	T_{ijk}	C_{ijk}	P_{ijk}	T_{ijk}	C_{ijk}	P_{ijk}	
1.																			
2.																			
3.																			
4.																			
5.																			
6.																			
																			P_{mtk}

The outcome is given in Table 2

Time vs. performance graph for this group is represented in Fig. 3.

Table 2

No.	Name	$k=1$ P_{mt1}	$k=2$ P_{mt2}	$k=3$ P_{mt3}	$k=4$ P_{mt4}	Observations
1	Fechet G.	14.2	12.8	11.6	10.4	Better performances
2	Popa E.	30.3	24.4	18.6	14.5	Efficient training
3	Bolea A.	29.4	27.6	22.3	19.6	Efficient training
4	Misăilă E.	26.6	24.3	22	20.6	Unefficient training
5	Ciubotaru L.	24.2	23.8	20.1	19.1	Unefficient training
6	Sărmăşan C. * worker	–	–	–	9.4	2 years experience
7	Medium rate of the students group	24.9	22.5	18.9	16.8	Training stage not enough, unefficient training

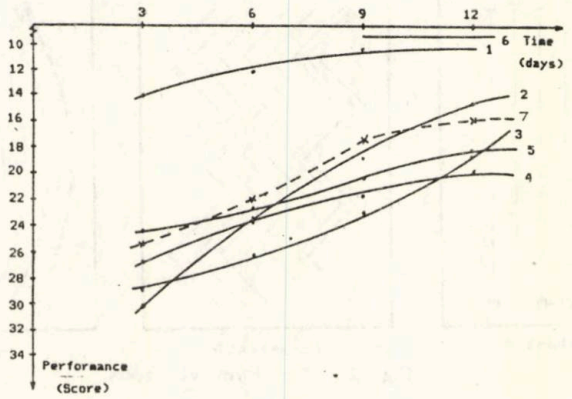

Fig. 3

5. Outcome Analysis. Analysing the experiment outcome, we could observe, a low training level, because the curves of the student's performances do not meet the reference curve. The student's training is not adequate, because the training stage is too short and some students are not interested to learn.

The first student, who worked for one year in a clothing factory, learned very quickly the work method and, we forsee that, in a short time, she can achieve the reference curve. For the second and third student, the curves of performances are growing very fast, even though they are at the beginning of these activities. They are able to become good employees for the clothing industries in a short time. The fourth and fifth students are not able to become good employees, because the curves are growing too slowly and they will need much time to learn the work method, at great costs. The employees like these students must be eliminated since this training stage.

6. Conclusions. The employees who are in training activities can be classified as following:

a) with good abilities (the employees who are able to learn the work method in a short time, with low costs);

b) normal (the employees with normal abilities, with a normal stage of training);

c) with low abilities (the employees who are not able to learn the work method in a short time).

Each employee, even if he is in the third or fourth stage of training, must be included in one of those classes. Using the graph time vs. performance method, we can make important savings, because we will train only the employees from the classes a) and b).

The method can be successfully applied in recruting human resources and it assures a high quality product.

The method can be extended. For different equipment and types of sews, we can formulate new form-tests, with different shapes. The form-tests will include the shapes of the most used sews in the production lines of the manufacturing firm.

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FOLOSIREA GRAFICULUI TIMP/PERFORMANŢĂ ÎN ASIGURAREA CALITĂŢII INSTRUIRII MUNCITORILOR DIN INDUSTRIA DE CONFECŢII TEXTILE

(Rezumat)

Se prezintă o metodă de apreciere a calităţii instruirii muncitorilor din industria de confecţii textile, metodă care permite aprecierea evoluţiei nivelului de îndemânare a muncitorilor pe măsura derulării programului de instruire.

Sunt prezentate rezultatele obţinute în urma aplicării acestei metode pe un grup de studenţi, realizându-se şi interpretarea acestor rezultate.

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Secţia VIII
TEXTILE. PIELĂRIE

VASILE COPILU
1911–1993

On 21st of October 1993 the distinguished Professor Vasile C o p i l u died. He was professor at the Faculty of Textile Engineering, the "Gh.Asachi" Technical University of Iaşi, and a well-known specialist in the field of spinning-weaving, greatly appreciated for his professional competence both in the country and abroad.

He was born on the 1st of June 1911, in a peasant family which lived in the county of Cluj. The primary and secondary schools he attented in his native village. Later on, at the same time, he attented the School of Arts and Professions and "Regele Ferdinand" High School in Turda; he graduated them both in 1929. Then he went to Cluj where he attended the College of Engineering. In 1933, after graduating, he went to England where he studied at Glasgow Textile College and came back home in 1937.

After his coming back he worked at "Romăno-Fir" in Tâlmaciu and later at "Ţesătura" in Iaşi, where he was in charge with different jobs which implied great responsabilities.

In 1957 he began to collaborate with Polytechnic Institute of Iaşi, and from 1960 up to 1975, when he retired, he was professor of "Processes and engines in spinning-weaving". Due to the quality of the professional information he offered and the systematic feature of his lectures, he contributed substantially to the preparation of good specialists.

He participated at the elaboration of some valuable manuals and treaties about spinning-weaving, printed at "Editura Tehnică". These still are basic books both for the students and the specialists who work in industry, research and design. His numerous research works (over 50) approached problems belonging to spinning-weaving, and they had in view the functional perfectioning and the growth of the efficiency of engines, the improving of the technologies, quality of fibers and of the products.

A main preoccupation in his activity was the organizing and leading the education process. He was the chairman of the Department of Spinning-Weaving between 1964–1975, vice-dean between 1961–1964 and then dean until 1973. Being devoted to higher education in textile, he worked skillfully and actively for solving a large number of problems related to the content and organizing of education. Thus, he was member of the interviewing panels for entrance and diploma exams, for teaching posts and Ph.D. degrees. He was also an active member of the Senate of the Polytechnic Institute of Iaşi.

Professor V. C o p i l u was an outstanding personality who constantly contributed to the formation of many generations of specialists in the field of spinning-weaving.

Distinguished collaborator of "Light Industry" Review and "Bulletin of Polytechnic Institute of Iaşi", professor V. C o p i l u will always be an example of honesty, who fought for the development of Romania higher education and spinning-weaving field.

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TEXTILE. PIELĂRIE

JOACHIM WERNER LÜNENSCHLOSS
1922–1993

Am 24. Dezember 1993 verschied der Verdiente Professor, Doktor-Ingenieur, Doctor Honoris Causa, Joachim Werner Lünenschloss, ein vornehmer Spezialist auf dem Gebiet der Textilindustrie aus Deutschland, erkannt und geschätzt von den Textilfachleuten aus aller Welt für seine professionelle Kompetenz.

Geboren in Wuppertal-Barmen, am 19. Februar 1922, führte er, nach dem Absolvieren des Lyzeums, die Hochschulstudien auf den tehnischen Universitäten aus Darmstadt und Stuttgart durch. 1951 angajierte er sich als Diplomingenieur in den gewesenen Glanzstoffsfabriken, heute das Konzern für AKZO-Fasern. Zwischen den Jahren 1952-1957, als delegierter (vertretender) Direktor im Institut für Fasertechnik aus Obernburg/Main, promovierte er mit Kompetenz die Entwicklung und Einführung der Polyesterfasern in der Spinnereien.

1957 trat er in die Deutschen Forschungsinstitute für Textilindustrie aus Reutlingen/Stuttgart ein, als Direktor des Instituts für Textiltechnik aus Reutlingen.

Während dieser Zeit funktionierte er auch als Dozent auf der Hochschule aus Reutlingen und als Mitglied des didaktischen Personals der Universität aus Stuttgart, wo er 1960 sein Doktorat erworbt.

1969 wurde er als Professor und Abteilungsleiter der Fachhochschule aus Reutlingen ernannt. Zwei Jahre später wurde er zum Titularprofessor des Katheders für Textiltechnik und zum Direktor des Instituts für Textiltecknik an der RWTH-Aachen ernannt.

Aus den über 300 Veröffentlichungen auf den Gebiet der Filamentgarntechnik, der Spinnerei, der Weberei und der Textilmaterialienforschung ist es schwer nur einige seiner Forschungsergebnisse hervozuheben. Es kann aber gesagt werden, dass seine teoretischen und wissenschaftlichen Befassungen immer in direkter Verbindung mit der Praxis standen, sowohl auf den Gebieten der Textilindustrie und der Chemiefassern, als auch des Textilmachinenbaus.

Er war stark engagiert in der Schultätigkeit, sicherte den Stundenten und Doktoranden eine hervorrangende Vorbereitung und brachte es dazu, seinen Mitarbeitern Leidenschaft für die Textilforschungsarbeit einzuflössen.

Die totale Anerkennung seiner jahrelangen Tätigkeit auf dem Gebiet der Textiltechnik stellen die zahlreichen Einladungen zu Kursen und Konferenzen dar, sowie die Zusammenarbeit mit nationalen und internationalen Körperschaften. Seine Erfolge wurde duch Verleihung von Auszeichnungen anerkannt, wie: Fellow of the Textile Institute (FTI) und die Memorialmedaille – S.G. Smith sowie die (goldene) Ehrenauszeichnung der Textilspezialisten aus Polen, und 1990 der Titel, Doktor Honoris Causa der Technischen Universität aus Lodz. Er war Dekan der Hochschule für Maschinenbau der RWTH-Aachen.

Der Verdiente Professor Dr.-Ing. Dr. H.C. Joachim Werner Lünenschloss wird im Gedächtnis der jenigen, die ihn gekannt haben, als ein Beispiel für professionelle Rechtschaffenheit, stark engagiert in die Etwicklung des textilen Hochschulwesens und der Textilindustrie bleiben.

Dr.ing. Gheorghe Antoniu

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FLORIN VĂLU
1923–1994

Pendant le jour de 14 mai 1994 est mort rapidement le professeur dr.ing. Florin V ă l u, qui a été cadre didactique de l'Université Technique „Gh.Asachi" de Jassy et Recteur en activité de l'Université „Aurel Vlaicu" de Arad.

Le professeur V ă l u est né le 29 mai 1923 dans la commune Coteana, department Olt; ses parents ont été paysans sages, travailleurs de la terre. Il a fréquenté l'école primaire dans la localité de naissance et étant un élève travailleur, en 1937 a été envoyé pour les études du lycée à Mediaş. Pendant le lycée Florin V ă l u s'est imposé comme le plus consciencieux élève de sa classe. Étant obligé de satisfaire son service militaire, en 1945 a participé aux luttes de Pyestoni, Tchécoslovaquie, contre les armées hitlériennes. Ultérieurement, il a été distingué avec deux médailles, comme symbole de sa reconnaissance comme combattant anti-fasciste.

Étant libéré du service militaire, au mois d'octobre 1945 il se fait inscrire à la Faculté de Chimie Industrielle de l'École Polytechnique de Jassy. Quoique les conditions d'étude étaient difficiles, déterminées par la deuxième guerre mondiale, l'étudiant Florin V ă l u a travaillé avec beaucoup d'ambition et il a obtenu de très bons résultats professionneles. À la fin des ses études universitaires il a été sélectionné pour l'activité de cadre didactique pour l'enseignement supérieur.

Ainsi, le premier octobre 1949 il a été nommé préparateur à la chaire de „Machines, Appareils et Installations Industrielles" de la Faculté de Chimie Industrielle de Jassy. Au mois de juin 1950 Florin V ă l u a soutenu la diplôme d'ingénieur et au premier octobre 1950 il a été nommé assistant à la même chaire.

En octobre 1952 il a été avancé lecteur pour l'Institut d'Industrie Légère, récent transferé à Jassy. Une fois à l'intégration du cet institut dans l'École Polytechnique de Jassy, en 1955, le conseil scientifique de la Faculté de Chimie Industrielle a décidé la maintenance de la chaire de finissage textile dans le cadre de cette faculté. Avec cette occasion Florin V ă l u a été intégré dans le collectif de cette chaire, étant chargé du cours pour la discipline „Machines, Appareils et Installation pour Finissage Textile". En 1956 le professeur Mişilin G r i n d e a (1910–1989), le titulaire de la chaire, a accepté mon opinion de nommer la section de finissage textile, section de „Technologie Chimique Textile".

En 1964 Florin V ă l u a soutenu son doctorat, avec un thème concernant l'influence de l'agitation des flottes de teinture sur le processus tinctorial. Par ce thème il a abordé un nouveau domaine de recherche, qui a été fondé scientifiquement et diversifié par ses recherches ultérieurs. Pour effectuer les investigations nécessaires à l'élaboration de sa thèse de doctorat, il a conçu et a construit un appareil pour agiter les flottes de teinture, qui a formé l'objet du son premier brevet d'invention. Par la soutenance de la thèse de doctorat Florin V ă l u est devenu le premier docteur-ingénieur de Roumanie pour la spécialité „Technologie Chimique Textile". Tout-de-suite il a été avancé maître de conférences (1965) et après professeur et titulaire de la chaire.

Comme cadre didactique Florin V ă l u s'est fait remarqué par une haute compétence professionnelle. Il a conduit didactiquement l'activité de séminaire, des travaux dirigés et de projet, en donnant toujours d'explication très précises; il était bien apprécié par les étudiants.

Son activité d'enseignement, commencée en 1952, s'est distinguée par des cours très bien

documentés, exposés avec une parfaite clarité et avec une remarquable aptitude didactique. Toute sa vie il a travaillé assidûment afin d'enrichir son bagage de connaissances de spécialité.

En qualité de cadre didactique il a été sollicité d'enseigner plusieurs disciplines scientifiques, par exemple: Processus et Appareils pour l'Industrie Chimique; Machines et Outillage pour les Fibres Artificielles et Synthétique; Machines et Outillage pour l'Industrie Textile; Procédés et Technologies Spéciaux; etc. Il a été toujours préocupé de perfectionner ses cours et de les préparer comme matériaux didactiques pour les étudiants. Le professeur Florin V ă l u a édité environ 15 cours et manuels, parmi lesquels 7 ont été publiés par maisons d'édition centrales. En même temps il a déployé une grande activité de recherche scientifique. Il a des contributions pour différents domains de la technologie chimique textile, à savoir: l'intensification des processus tinctorials par l'agitation mécanique des flottes de teinture, ou bien à l'aide des champs électromagnétiques, des champs électriques de haute fréquence, des ultra-sons, des radiations infrarouges, des radiations ultraviolettes, etc. De même il a d'importantes contributions concernant l'intensification du transfert de masse et chaleur dans les processus de finissage textile, fondé par l'action des microondes, du champ électrique de haute fréquence et des ultra-sons.

Ses travaux scientifiques ont été présentés aux plusieurs congrès et conférences internationales et également aux symposiums de Roumanie. L'activité scientifique du professeur V ă l u est matérialisée par la publication en plus de 200 travaux, 27 brevets, 5 innovations, 46 contracts de recherche scientifique, 27 prototypes d'appareils et dispositifs de laboratoire conçus par lui même, etc. De plus, il a contribué à l'élaboration d'un dictionnaire technique polyglotte pour finissage textile.

Son activité de recherche scientifique a été appréciée également à l'étranger; ainsi, il a été élu membre de l'Association Américaine pour Science et Progrès de Washington en 1974, membre actif de l'Académie de Science de New York en 1979 et membre de la Société Internationale pour Computation des Méthodes de la Profession de l'Ingénieur de London, en 1981.

Le professeur V ă l u a apporté une contribution de grande valeur concernant l'organisation et la dotation des laboratoires de spécialité et particulièrement des stations pilot. Premièrement il a aménagé une station-pilot dans le cadre de la chaire de technologie chimique textile (1960–1965); cette station a été réarrangée et amplifiée sur la plate-forme industrielle de l'usine „Ţesătoriile de Mătase" de Jassy, où la chaire a fonctionné quelques années. En 1976 la section de Technologie Chimique Textile et également la section de Technologie Chimique du cuir ont été transférées, sans le consentement des professeurs, dans le cadre de la faculté de textile. Avec cette occasion Florin V ă l u est devenu professeur de cette faculté.

Après la construction des nouveaux bâtiments de la faculté de textile et l'installation de la chaire sur la nouvelle plate-forme, le professeur Florin V ă l u a contribué notablement pour l'organisation des laboratoires et l'aménagement de la troisième station-pilot, dans un local propre. Pour doter cette station et pour installer les machines il a fait souvent des efforts financiers personnels, de son salaire.

Bien qu'il a été passé à la retraite en 1988, il n'a pas cessé son activité de documentation et recherche. Étant connu comme un authentique spécialiste pour le finissage textile, en 1992 il a été invité honorer l'enseignement supérieur de Arad. Le ministère d'enseignement a aprouvé la réintégration du professeur Florin V ă l u à l'Université „Aurel Vlaicu" de Arad. Là, pendant une courte période de temps, il s'est imposé comme un professeur de prestige, un admirable organisateur et c'est qui a conduit à son élection comme recteur de cette université, en 1993. En cette fonction de haute responsabilité il a travaillé avec une grande compétence et courage. Son comportement a gagné la bienveillance des autorités de Arad et également des collègues, des étudiants, des institutions productives, etc. Tous étaient contents et heureux de sa présence.

On peut apprécier que le professeur Florin V ă l u, comme spécialiste, est comparable avec le professeur G r i n d e a, mais qu'il l-a dépassé par les réalisation scientifiques et publications.

Toute sa vie le professeur Florin V ă l u a travaillé sans cesse, ayant toujours des bons résultats, sans négliger ses obligations familières. Il a contribué à l'instruction d'un grand nombre de spécialistes de domaine du finissage textile. Aujourd'hui, tous les ingénieurs, spécialistes en technologie chimique textile, se trouvant en production, sont les élèves du professeur V ă l u.

Sa mort inattendue, en pleine activité didactique et administrative, constitue une douloureuse et irréparable perte pour l'enseignement supérieur et la recherche scientifique. Tous qui l'ont connu, cadres didactiques, étudiants, collaborateurs, ingénieurs et travailleurs garrderont l'image du professeur Florin V ă l u avec profond respect et haute appréciation.

Prof.dr.ing. Sarel Ifrim

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SIDORA PREDA
1939–1994

On 11 July 1994 died after a serious illness lecturer eng. Sidora P r e d a, prestigious professor at the Technical University "Gh.Asachi", Iaşi, Faculty of Textile and Leather, where she worked with devotion and abnegation over thirty years.

She was born at 7 october 1939 in the city of Drobeta-Turnu Severin. She attended the primary and the high school in her native town, with very good results in the learning process.

Between 1957-1962 she attended the courses at the Faculty of Light Industry in Iaşi, field Mechanical Technology of the Knitwear and Ready-made Clothes. Her very good professional results during high-school studies enable her to be direct distributed at the Polytechnic Institute of Iaşi, Department of Knitting and Apparel. She worked here as instructor, assistant and since 1977 she became lecturer, directing the courses of Knitting Fabrics Construction and Technology, the Fundamentals of Knitwear and Ready-made Clothes, Processes and Machines in Knitting and Knitwear Construction and Design. During her teaching work, she elaborate and printed the courses for the disciplines Knitwear Technology and Construction, the Fundamentals of Knitwear and Ready-made Clothes and she was co-author to the Notes for the Practical Work, and also to the Problems in the field of knitting technology.

She had a great contribution to the forming of many graduates of knitting engineers, distinguishing her teaching talent, the clarity of her courses, the abnegation and the attachment to the students who work with her to the graduation project and to the students' scientific workshops. She also contributed to the professional training of the knitting engineers through the lectures that she has given in the frame of the post graduation courses.

Sidora P r e d a had also a full presence in the scientific research activity of the knitting research team from the Faculty of Textile and Leather; contributing to more than 100 scientific publications, issued in the professional magazines or in the volumes of the scientific sessions and contracts with research institutes and production units from the country. She had also remarkable contributions in the fields of the sandwich constructions and the superior valorification of the new yarns. For her contributions to the forming of knitting technologists and for her scientific activity she was distinguished with the Honor Diploma of the Romanian Textile Engineers' Society.

Bringing an homage to the tenacious work of those who has been Sidora P r e d a and to her contribution to the development and recognision of the romanian technical high-school, we expressed our regret for this great loss, both for the family and for the faculty with which was connected her activity for 37 years, with the hope that her memory remains active for collegues, the students, the engineers that she had trained and for all people who known her.

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